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Opinion 572. Suppression under the plenary powers of the generic name *Calandra* Clairville & Schellenberg, 1798, and validation under the same powers of the specific name *abbreviatus* Fabricius, 1787, as published in the binomen *Curculio abbreviatus* (Class Insecta, Order Coleoptera).—*Bull. zool. Nom.* **17** pt. 3–5 pp. 112–116. London, 1959.

The result of this Opinion of the International Commission is that the name *Calandra* (and its alternative spelling *Calendra*) is suppressed, that the generic name *Sitophilus* (type species *Curculio oryzae* L.) is to be used for the grain weevils (*Curculio granarius* L., *C. oryzae* L. and related species) commonly referred to *Calandra*, and the generic name *Sphenophorus* (type species *Curculio abbreviatus* F.) for the root weevils for which *Calendra* has sometimes been used. As regards specific names, the amended spelling *oryzae* for *Curculio oryza* L. is accepted and *C. abbreviatus* F. is validated although it is a junior homonym of *C. abbreviatus* L., which is a species of *Diaprepes*. *C. elegans* Fourcr., by some considered an earlier name for *C. abbreviatus* F., is suppressed.

The reference collection of insects in the Faculty of Agriculture, University College, Ibadan.—*Divl Rep. Fac. Agric. Univ. Coll. Ibadan* no. 4 (Ent.), [1 +] 61 pp., multigraph. Ibadan, 1959.

The reference collection of insects in the faculty of agriculture of University College, Ibadan, Nigeria, was established in 1951 with a gift representing about 100 known pests that occur in West Africa, and has since been supplemented by identified material collected locally, mostly from crops and livestock. It now comprises some 2,000 species, a list of which is given.

Metcalf (R. L.). Ed. **Advances in pest control research. Volume II.**— $9\frac{1}{4}$ × 6 in., vii + 426 pp., 110 figs., many refs. New York, N.Y. & London, Interscience Publishers, Inc., 1958. Price £4 14*s*.

The articles in this second volume of a series [*cf. R.A.E.*, A **45** 394] include **The fluid kinetics of application of pesticidal chemicals,** by R. P. Fraser (pp. 1–106, 53 figs., 113 refs.), which is a review of the results and trends of modern fundamental research on the fluid mechanics of the dissemination of insecticides in sprays; **Research advances in seed and soil treatment with systemic and nonsystemic insecticides,** by H. T. Reynolds (pp. 135–182, 5 figs., 140 refs.), which comprises discussions of seed treatment with non-systemic insecticides, various types of treatment with systemic insecticides at the time of sowing, the application of systemic insecticides to the soil at a later date, and the residue problems that arise; **Isotope dilution techniques for the determination of pesticide residues,** by C. T. Redemann & R. W. Meikle (pp. 183–206, 6 figs., 16 refs.), in which a method of residue determination involving dilution of the material initially present in the sample with a precisely known quantity of a particular isotopic form (either stable or radioactive) of the same substance is described, with particular reference to the dilution of non-radioactive residues with radioactive isotopes, and illustrated from work with a herbicide; **Wool digestion and mothproofing,** by D. F. Waterhouse (pp. 207–262, 5 figs., 212 refs.), in which the subjects reviewed include the insects that digest keratin, the structure and chemical composition of wool, its digestion by insects,

methods of protecting it from attack, including modification of its molecular structure, and the action of mothproofing agents; **Chemical structure and activity of DDT analogues with special consideration of their spatial structures,** by R. Riemschneider (pp. 307–350, 27 figs., 50 refs.), who concludes that there is a correlation between the contact toxicity of DDT analogues and the degree of rotatability of their molecular components, which is supported by measurement of the dipole moments of suitable analogues, and consequently that the configuration of such analogues can be taken as a further criterion for judgment of their activity; and **The spread of insecticide resistance in pest species,** by A. W. A. Brown (pp. 351–414, 564 refs.), which consists primarily of a review of the large number of insects, mites and ticks in which the development of resistance to insecticides has been demonstrated or claimed and of some that are remarkable for lack of induced resistance. In addition to a subject index, a cumulative index of the articles appearing in the two volumes so far published is included.

Shepard (H. H.). Ed. **Methods of testing chemicals on insects. Volume II.**—$8\frac{3}{4} \times 5\frac{3}{4}$ in., [4+] iii + 248 pp., 16 figs., 27 pp. refs. Minneapolis, Minn., Burgess Publ. Co., 1960. Price £2 or $5.

This second volume of a series [*cf. R.A.E.*, A **46** 508] is devoted mainly to discussions of factors affecting the results of experiments with insecticides and preliminary testing. The reviews in it comprise **Pre-test conditions which affect insect reaction to insecticides,** by Yun-pei Sun (pp. 1–9, 1 graph); **Factors affecting insects during exposure to insecticides,** by J. C. Gaines & W. J. Mistric jr. (pp. 10–18); **Post-exposure conditions and determination of end-point,** by R. L. Beard (pp. 19–27); **Exposure to treated food medium,** by A. W. A. Brown (pp. 28–33); **Screening space sprays against flies and cockroaches,** by R. H. Nelson (pp. 34–46); **Soil insecticides,** by W. E. Fleming (pp. 47–72); **Testing resistance of chemically-treated textiles to insect damage,** by M. M. Walton & H. H. Shepard (pp. 73–100, 1 fig.); **Screening chemical repellents,** by P. Granett & E. B. Starnes (pp. 101–119); **Insectproofing of food packaging materials,** by B. C. Dickinson & E. J. Incho (pp. 120–130, 2 figs.); **Screening chemical attractants,** by J. T. Medler (pp. 131–155); **Testing acaricides,** by W. Ebeling (pp. 156–192, 7 figs.), which is concerned with phytophagous mites; **Animal sprays, dusts, dips, and dressings,** by R. C. Bushland (pp. 193–199); and **Techniques for evaluating systemic insecticides against livestock insects,** by O. H. Graham (pp. 200–216, 5 figs.).

Barnes (H. F.). **The gall midges (Dipt., Cecidomyidae) of timothy grass inflorescences, with the description of one new species.**—*Ann. ent. fenn.* **24** no. 2 pp. 59–68, 4 figs., 6 refs. Helsinki, 1958.

Cecidomyiid larvae found in inflorescences of timothy grass (*Phleum pratense*) at Nivala, Finland, on 19th August 1955 were sent to Harpenden, England, and kept in cages. They gave rise to adults between 18th June and 11th July 1956, and these are described from both sexes as *Contarinia kanervoi*, sp.n. Parasites that also emerged from the material comprised *Prosactogaster* sp., *Platygaster* sp., *Leptacis tipulae* (Kby.) and a species of *Tetrastichus*, possibly *T. brachycerus* Thoms. *C. kanervoi* is difficult to distinguish morphologically from other species of *Contarinia* that breed in

the inflorescences of grasses, but can be recognised by its yellow colour while alive or freshly killed. When newly-emerged females were caged with males on a timothy plant on 25th June 1956, they oviposited, full-grown larvae were found on 16th July and adults emerged in June 1957, suggesting that there is one generation a year. *C. kanervoi* could not be found in the open at Harpenden, but observations there showed that the summer generation of *Stenodiplosis geniculati* Reut. breeds on *Phleum pratense*, and it is suggested that different populations of this species may develop at different rates on it and on meadow foxtail (*Alopecurus pratensis*) and cocksfoot (*Dactylis glomerata*), which were already known as food-plants. It was parasitised by the same species of *Tetrastichus* as *C. kanervoi*. Of other species found in the inflorescences of *P. pratense* at Harpenden, one of *Dasyneura* is considered a possible pest, one of *Clinodiplosis* an inquiline and one of *Lestodiplosis* a predator.

Heqvist (K. J.). **Notes on *Bracon hylobii* Ratzb. (Hym. Braconidae), a parasite of the pine weevil (*Hylobius abietis* L.).**—*Ann. ent. fenn.* **24** no. 2 pp. 73–78, 5 figs., 12 refs. Helsinki, 1958.

During investigations on *Hylobius abietis* (L.) attacking pines in Sweden, larvae and cocoons of *Bracon hylobii* Ratz., one of its few insect enemies, were collected in 1953–55. As the parasite has often been wrongly identified, the adult male and female are redescribed, and notes are given on the appearance of other stages [*cf. R.A.E.*, A **2** 661] and on its bionomics. The Braconid occurs in England, Germany, Austria, the Soviet Union and Denmark and probably throughout the forest area of Sweden, where it was also collected on *Pissodes* larvae in 1940. It is an ectoparasite and has four larval instars lasting 1–2 days each and a fifth lasting 2–3 days. Up to 12 larvae may attack a single host larva. Winter is passed in the pupal stage, and the adults emerge in spring and pair immediately. Oviposition begins soon after but is confined to larvae on the soil surface; the Braconid cannot reach larvae below the surface, where the majority develop, and so does not give effective control.

Nuorteva (P.). **On the nature of the injury to plants caused by *Calligypona pellucida* (F.) (Hom., Areopidae).**—*Ann. ent. fenn.* **24** no. 2 pp. 49–59, 4 figs., 32 refs. Helsinki, 1958.

The following is based on the author's summary. *Calligypona pellucida* (F.) causes serious damage to oats in the western coastal area of Finland, but not in other parts of the country, although equally numerous [*cf. R.A.E.*, A **46** 405]. In investigations, no protease or amylase was found in the salivary glands of adult males or females or last-instar nymphs of injurious and non-injurious populations, but tests in which sections of bean stem were grown in nutrient solutions containing crushed salivary glands revealed the presence of growth-inhibiting substances in insects from an injurious population and not in those from non-injurious ones. It has been observed that the severity of the injury increases with the number of insects and the duration of feeding [*cf.* next abstract], and the author concludes that it is due not to a virus [*cf.* **47** 407; **48** 162], but to phytotoxicity of the saliva, probably caused by the nature of the food available in the district, though the occurrence of phytotoxically different strains of the Delphacid is possible.

KANERVO (V.). **Kaurantuhotutkimuksesta.** [Investigations on damage to oats.]—*Maatalous ja Koetoim.* **12** pp. 118–131, 8 figs., 9 refs. Helsinki, 1958. (With a summary in German.) Also in Swedish as *Sv. LantbrSällskap. Finland Förb.* Ser. B no. 20, 20 pp., 10 figs., 9 refs. [Helsinki] 1958.

The following is based on the author's summary. Investigations on *Calligypona* (*Delphacodes*) *pellucida* (F.), which causes severe damage to oats in western Finland, showed that the degree of injury depended on both the duration of feeding and the time at which it began [*cf.* also preceding abstract]. A population of one insect per 1–2 plants destroyed about 90 and 60 per cent of the crop in 1956 and 1957, respectively, in test plots, and similar differences were observed in the field. The lighter damage in 1957 was evidently due to retarded development of the insects in spring and to weather conditions that were very favourable for oats in summer.

Damage to oats by *C. pellucida* is widespread in the west-coast area and has appeared in a few inland places [*cf. R.A.E.*, A **46** 405]; it seems to have spread for about six miles a year in many districts. Examples from other parts were shown to have caused less interference in the growth of oats than those from the principal damaged areas. *C. pellucida* feeds and reproduces on all the cereals grown in Finland, particularly those sown in spring, but has caused severe damage only to oats. Large populations can noticeably affect the growth of spring wheat and barley, but such damage has not been observed in the field. *C. pellucida* also feeds on wild grasses, particularly timothy [*Phleum pratense*] and couch grass [*Agropyrum repens*]. Control measures that have been investigated comprise the production of resistant varieties of oats, the applications of insecticides and cultural methods.

RAATIKAINEN (M.) & TINNILÄ (A.). **Viljakaskaan** (*Calligypona pellucida* **F.) aiheuttaman kaurantuhon vaikutus kauran viljelyalaan ja satoihin Suomessa.** (The effect of the damage to oats caused by *Calligypona pellucida* F. on the acreages and yields of oats in Finland.)—*J. sci. agric. Soc. Finland* **31** pp. 49–66, 8 figs., 16 refs. Helsinki, 1959. (With a summary in English.)

The following is based on the author's summary of this paper, in which information collected from farmers and agricultural societies on the effect of injury by *Calligypona pellucida* (F.) to oats in Finland is reviewed [*cf.* two preceding abstracts]. Damage is greatest in the early stages of plant growth, and the symptoms vary in different habitats and different years. Reproduction occurs mainly on cereals, but grasses, particularly timothy [*Phleum pratense*], are important food-plants of the nymphs. Injury was first reported in 1948, and it spread rapidly until 1954–55, when low yields of oats led to a great reduction in the acreage sown. There were increases in yield in 1957–58, perhaps because of a reduction in populations of *C. pellucida*, and if these continue the area may again increase.

EKHOLM (S.). **Småfjäriln** *Simaethis pariana* **Cl. som skadedjur i Finland.** [*Anthophila pariana* as a pest in Finland.]—*Notul. ent.* **38** (1958) no. 3 pp. 87–90, 1 map, 10 refs. Helsinki, 1959. (With a summary in English.)

Anthophila (*Simaethis*) *pariana* (Cl.) has long been known in Finland but has been of little importance until recent years, when it has been found

on apple and sometimes on pear and *Sorbus*. It has two generations a year in the south, and the adults overwinter. Damage to the leaves is severe in some years. The distribution of the moth in Finland is shown on a map.

EKBOM (P.). **Husbockens förekomst och skadegörelse i Finland.** [Distribution and harmfulness of *Hylotrupes bajulus* in Finland.]—*Flyvehullet* no. 182 pp. 80–85, 2 figs., 4 refs. Copenhagen, 1957. (With summaries in German & English.)

The author states that *Hylotrupes bajulus* (L.) has been present in the Åland islands for about 200 years, but has not been observed on the mainland of Finland. The serious damage caused to timber buildings on one of the islands is described.

PALM (T.). **Följdverkningar av fjällbjörkmätarens härjning i Abiskodalen 1954–1956. En koleopterologisk undersökning somrarna 1958 och 1959.** [The consequences of the outbreak of *Oporinia autumnata* in the Abisko Valley in 1954–56. A Coleopterological investigation in the summers of 1958 and 1959.]—*Ent. Tidskr.* **80** pt. 3–4 pp. 120–136, 8 figs., 6 refs. Lund, 1959. (With a summary in German.)

Forests of birch (*Betula tortuosa*) in northern Sweden were severely defoliated in 1954–56 by an outbreak of the Geometrid, *Oporinia autumnata* (Bkh.). The damage was very heavy in the tourist district of the Abisko valley, where tree mortality occurred over large areas. Investigations in 1958–59 showed that this was due partly to concurrent outbreaks of *Hylecoetus dermestoides* (L.) and *Agrilus viridis* (L.), which attacked the damaged but still living trees, the former being the more injurious. The habits of these beetles and the changes in vegetation that occurred as a result of the mortality are described.

PALM (T.). **Die Holz- und Rinden-Käfer der süd- und mittelschwedischen Laubbäume.** [The wood- and bark-beetles of deciduous trees in southern and central Sweden.]—*Opusc. ent.* Suppl. 16, 374 pp., 47 pls., 5 pp. refs. Lund, 1959. (With summaries in Swedish & English.)

This survey of the Coleoptera that live in the wood or bark of deciduous forest trees in central and southern Sweden is complementary to the earlier one on northern Sweden [*R.A.E.*, A **40** 361] and is arranged in a similar manner. It is based on investigations carried out in 1952–57, and includes information on 820 species in 60 families.

ROLAND (G.). **Étude d'un virus du chrysanthème.**—*Parasitica* **15** no. 2 pp. 43–52, 2 pls., 9 refs. Gembloux, 1959.

A virus that is common in chrysanthemum plants in Belgium was studied in 1955–56, and the results indicated that it was identical with Noordam's chrysanthemum strain of *Cucumis* virus I [*cf. R.A.E.*, A **45** 329] and with the tomato aspermy virus [*cf.* **43** 280]. In tests, *Myzus persicae* (Sulz.) transmitted it from infected *Nicotiana glutinosa* to tobacco when the feeding period on the forms did not exceed two minutes, and from infected to healthy petunia after feeding on the infected plants for 1–2 minutes,

but not when the aphids were allowed to remain on the infected petunias for 24 hours. *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.) [*cf.* **45** 128] also transmitted it between petunias. *Anuraphis helichrysi* (Kalt.) transmitted it to petunia from chrysanthemum, but only after feeding on the infected plant for 15 seconds, and it failed to effect transmission from infected to healthy chrysanthemum.

Van Steyvoort (L.). **Le blaniule moucheté, possibilités de lutte.**—*Publ. tech. Inst. belge Amélior. Better.* **26** no. 2 pp. 73–84, 2 figs. Tirlemont, 1958. (With summaries in Flemish & English.)

Blaniulus guttulatus (Bosc) has occurred in Belgium with increasing frequency since 1950 as a pest of sugar-beet. The millepedes appear in the fields in early May, so that late varieties of beet are most usually attacked, and they injure the germinating seeds and the root hairs of the young seedlings. The latter are susceptible until they reach the two-leaf stage if infestation is light, but they are attacked until they have formed four, or exceptionally six, leaves in heavier infestations. In field tests on heavily infested plots in 1958, a normal stand of a late variety was obtained when broadcast applications of 9 or 18 lb. per acre of commercial preparations containing 7·5 per cent. γ BHC (as lindane) or 25 per cent. aldrin were made immediately before sowing, on 22nd April, or the seed balls were treated with an undefined systemic insecticide (Bayer 43.10a). Seed treatment with γ BHC or aldrin was less effective, since 5–10 per cent. of the plants were stunted. The effects of the treatments on *B. guttulatus* were difficult to assess; on 12th May, there appeared to be fewer millepedes on the roots of plants from seed treated with the systemic insecticide, which may have had a repellent action, and by the end of May there were fewer living millepedes in the treated plots than in the untreated ones, on which the plants were completely destroyed, but in general it appeared impossible to control the millepedes while the seed was germinating. High-volume sprays of γ BHC, heptachlor and dieldrin, applied on 31st May, after the emergence of the seedlings, were of no value.

Benassy (C.). **Remarques sur l'écologie de *Quadraspidiotus perniciosus* Comst. dans le Midi méditerranéen (Hom. Diaspidinae).**—*Entomophaga* **3** no. 2 pp. 93–108, 6 figs., 13 refs. Paris, 1958. (With a summary in English.)

Quadraspidiotus perniciosus (Comst.) is an important pest of fruit trees in the French department of Alpes-Maritimes. As its population remains fairly constant from year to year, factors affecting its reproduction rate were investigated in 1955–57 in an apple orchard at Mandelieu, in the Siagne valley. It was found that the Coccid overwinters predominantly as the first-stage nymph, 91·3 and 91·2 per cent. of the population on 1st February 1955 and in late December 1956, respectively, being in that stage. Feeding is resumed in January or February, and adults are present in March, although no winged males appear until mid-April. Crawlers of the first generation are produced in early May and reach maximum numbers towards the end of the month. Males of the first and second generations mature in late June or early July and in mid-August, respectively, but about 10 per cent. of the first-stage nymphs of the second generation enter diapause at the beginning of September [*cf. R.A.E.*, A **46** 394]. Crawlers of the third generation appear in mid-September, and in 1955 they comprised 37·7 per cent. of the population on 17th September and 94·5 per cent. on 7th November. Newly-emerged crawlers usually

infest young twigs, but in 1956 a complete generation was passed on the fruits before they were harvested, the calyx and stalk depressions being preferred. Observations during the three years showed that the first generation was present from 5th–20th May to 15th–31st July, the second from mid-July to mid-September or 10th October, and the third from then onwards.

Apart from physiological age, the main factor in mortality appeared to be the weather, which was unfavourable for survival in late autumn and at the end of winter and reduced the numbers of crawlers in summer, so that the population remained fairly constant. Natural enemies were of little importance. Predators, comprising *Chilocorus bipustulatus* (L.) and a Nitidulid of the genus *Cybocephalus*, occurred sporadically, but Aphelinid parasites were constantly present. The most numerous was *Aphytis proclia* (Wlk.) [*cf.* **44** 105, etc.], an ectoparasite of the females, followed in order of decreasing abundance by *Prospaltella aurantii* (How.) and *Aspidiotiphagus citrinus* (Craw) [*cf.* **45** 117], which are parasitic in all fixed stages. The numbers of *Aphytis*, *Prospaltella* and *Aspidiotiphagus* emerging from collections of about 4,000–5,000 Coccids in 1957 were 461, 213 and 113, respectively; they were rather less numerous in 1956, but occurred in similar proportions. All three reached population peaks in autumn, after remaining at low levels in spring and summer. Parasitism did not exceed 15–20 per cent. in the autumn of 1956, and was of much less importance than weather. The seasonal cycles of the parasites, each of which has three generations and a partial fourth in the year, are described.

Franz (J. M.). **Studies on *Laricobius erichsonii* Rosenh. (Coleoptera: Derodontidae), a predator on Chermesids. Part I. Distribution, life-history and ecology.**—*Entomophaga* **3** no. 2 pp. 109–164, 27 figs., 33 refs. Paris, 1958. **Part II. External anatomy.**—*T.c.* pp. 165–196, 56 figs., 8 refs. (With summaries in German.)

The first part of this paper is an expanded version of one already noticed [*R.A.E.*, A **42** 280] and comprises detailed accounts of the European distribution of *Laricobius erichsonii* Rosenh. and of investigations on its bionomics and ecology carried out in 1950–52 mainly near Munich. This Derodontid preys on *Chermes* (*Adelges*) *piceae* Ratz. on fir, *Abies alba* (*pectinata*), there, and it was introduced into Canada in 1951–52 for trial against *C. piceae* on balsam fir, *A. balsamea* [*cf.* **48** 68]. The Ichneumonid of the tribe Phrudini found parasitising the larvae [**42** 281] is described by J. F. Perkins from females originating near Zürich (Switzerland) and Munich as *Echthrolaricobius paradoxus*, gen. et sp. n. It is thought to be specific to *L. erichsonii* and is further recorded from other localities in the two countries; the male is unknown. The second part of the paper comprises descriptions of all stages of *L. erichsonii*. The first- and second-instar larvae feed on the eggs of *C. piceae*, but in the third and fourth instars they also eat adults and immature stages; they pierce the egg or body-wall and suck out the contents. A fourth-instar larva was observed to empty six eggs in succession in 1 min. 20 sec., 2 min., 2 min. 25 sec., 2 min. 10 sec., 3 min. 5 sec. and 4 min., and a seventh egg was abandoned after 40 sec. No cannibalism was observed when larvae of different ages fed from the same egg-cluster. Larvae eliminated or greatly reduced light infestations of *C. piceae* on *Abies alba*, often in association with the Coccinellid, *Scymnus* (*Pullus*) *impexus* Muls., but neither was capable of controlling a heavy infestation in the absence of other predators. The average numbers of eggs eaten daily by a single larva increased from 7·2 in the first instar to 37·5.

Vago (C.) & Vasiljevic (L.). **Polyédrie cytoplasmique chez l'écaille fileuse (*Hyphantria cunea* Drury, Lep. Arctiidae).**—*Entomophaga* **3** no. 2 pp. 197–198, 2 refs. Paris, 1958.

A nuclear polyhedral virus referable to the genus *Borrelina* was recorded from larvae of *Hyphantria cunea* (Dru.) in Yugoslavia by the authors in 1953 [*cf. R.A.E.*, A **45** 331]. A cytoplasmic polyhedrosis of the same insect has also been observed there and is becoming common; the name *Smithia hyphantriae* is proposed for the virus responsible. The symptoms caused by these viruses are described, and it is stated that both may occur in the same larvae.

Jermoljev (E.) & Šedivý (J.). **Mandelinka bramborová jako vektor X-viru brambor . . . The Colorado beetle as the vector of the X-virus of potatoes.**—*Sborn. čsl. Akad. zeměd. Věd* Rostl. Výroba **4** (**31**) pt. 5 pp. 577–580, 10 refs. Prague, 1958. (With summaries in Russian, English & German.)

In experiments in Czechoslovakia, starved adults and larvae of *Leptinotarsa decemlineata* (Say) were allowed to feed on potato infected with X-virus and were then transferred to *Datura stramonium*. The virus was transmitted by feeding in two of 20 tests with contaminated adults and in three of 32 with larvae. It passed through the digestive tract unchanged, its presence in different parts of the intestine of the beetles and in their excreta being detected by inoculation into tobacco leaves, and was transmitted by means of the excreta in six tests.

Zakopal (J.) & Dlabola (J.). **Pěnodějka obecná jako škůdce kmínu . . . The froghopper as a cumin pest.**—*Sborn. čsl. Akad. zeměd. Věd* Rostl. Výroba **4** (**31**) pt. 9 pp. 1019–1024, 3 figs., 5 refs. Prague, 1958. (With summaries in Russian, English & German.)

The authors record that *Philaenus leucophthalmus* (L.) (*spumarius*, auct.) was found damaging cumin [*Cuminum cyminum*] in Czechoslovakia for the first time in 1956, give a short account of its bionomics and ecology, and describe the damage caused by the nymphs. Infested plants became stunted or deformed and damaged umbels did not produce seed. Sprays of BHC or toxaphene, applied at an early stage in the development of the flower stems, gave the best control.

Kazda (V.). **Hálkovité deformace, způsobované krytonescem řepkovým (*Ceuthorrhynchus napi* Gyll.) na koštálovinách a řepce a poznámky k etiologii zoocecidií . . . Gall-like deformations, caused by *Ceuthorrhynchus napi* Gyll. on brassicas and on rape, and notes concerning the etiology of zoocecidia.**—*Sborn. čsl. Akad. zeměd. Věd* Rostl. Výroba **4** (**31**) pt. 9 pp. 1153–1162, 2 figs., 30 refs. Prague, 1958. (With summaries in Russian, English & German.)

Gall-like deformations occur on rape and other crucifers after the insertion of eggs of *Ceutorhynchus napi* Gyllh. [*cf. R.A.E.*, A **40** 323], and two cultures of bacteria and one of a yeast, isolated from the oviducts of the females in Czechoslovakia, were found to cause similar damage when injected into rape and kohl-rabi, indicating that symbiotic micro-organisms introduced into the plant during oviposition participate in the formation of the galls.

Danilevskiĭ (A. S.). Ed. **The ecology of insects.** [*In Russian.*]—*Uchen. Zap. Leningr. gosud. Univ.* no. 240 (Ser. biol. Nauk no. 46) 160 pp., illus., refs. Leningrad, 1958.

This book includes seven papers on insects associated with plants, abstracts of which appear below.

Gorȳshin (N. I.). **Ecological analysis of the seasonal cycle of development of the cotton bollworm** (*Chloridea obsoleta* **F.) in the northern regions of its distribution,** pp. 3–20, 7 graphs, 1 map, 18 refs. *Heliothis armigera* (Hb.) (*Chloridea obsoleta*, auct.) is a well-known pest of cotton in Soviet Azerbaijan and central Asia and has recently become more injurious in the north of its area of distribution, in the North Caucasus and the south of the Ukraine, where it causes severe damage to cotton, tomato and tobacco. Investigations on its annual cycle of development in such regions were carried out in Krasnodar and Stavropol in 1951–52 and in the laboratory, with special reference to the pupal diapause, and the following is based on the author's summary of the results.

The diapause in *H. armigera* is regulated by seasonal changes in daily photoperiod. The critical limit for development without diapause depends on temperature and is 14 hours of daylight at 25°C. [77°F.]. Reducing the temperature during the period of larval development raises this limit, and the onset of diapause in nature is thus variable. The reaction to photoperiod is modified by food factors. The diapause is eliminated at a wide range of temperatures, from 0 to 30°C. [32–86°F.]. In nature, it ceases at the beginning of winter, but resistance to low temperatures persists in the pupae until the occurrence of temperatures permitting development. The threshold for the resumption of development in spring ranges from 18·5 to 11°C. [65·3–51·8°F.], and the high threshold during the early stages is the cause of the late spring emergence of moths in the North Caucasus. The observed changes in the threshold in the course of development of the overwintered pupae have permitted corrections to be made in the method of forecasting adult emergence. The northern limit of distribution of the moth in a continental climate depends on the cold-hardiness of the overwintering pupae, whereas under the milder conditions of western Europe, the heat requirements of the active stages determine the distribution. There seems no probability of an extension of distribution to still more northerly regions.

Geĭspits (K. F.). **The adaptive significance of the photoperiodic reaction and its rôle in the ecology of the pine Lymantriid** (*Dendrolimus pini* **L.),** pp. 21–33, 1 graph, 20 refs. The dependence of diapause on short photoperiod has been demonstrated for numerous species of insects, and insects in diapause are resistant to cold, but it is not clear whether cold-resistance results from the diapause or from other factors. Experiments were therefore carried out to compare the cold-resistance of the larvae of *Dendrolimus pini* (L.) in an active state and in diapause, under a variety of conditions, and to elucidate the significance of cold-hardiness in a species with a wide area of distribution. The following is based on the author's summary of the findings.

The diapause, resulting from change in photoperiod during the period of larval development, ensures a normal degree of cold-hardiness in the overwintering larvae, and temperature during the feeding period has little effect on it. The difference in cold-hardiness between larvae in an active state and in diapause amounts to about 6–8°C. [10·8–14·4°F.] and permits survival of larvae in their overwintering sites. The hibernating larvae are in a supercooled condition, and the formation of ice in the tissues leads to death. The critical photoperiod below which diapause occurs is different for the southern and the northern form of *D. pini*, and this determines the

time at which diapause occurs in nature. In estimating the possibility of a spread of geographical forms of an insect within its total area of distribution, account should be taken of their adaptation to climatic conditions and notably of their reactions to changes in day-length, which determine correctly timed preparation for hibernation.

Danilevskiĭ (A. S.) & Beĭ-Bienko (I. G.). **The oak tortrix (*Tortrix viridana* L.) and the problem of the resistance of oaks to infestation by this and other pests,** pp. 61–76, 2 graphs, 9 refs. Heavy infestation of oak by *Tortrix viridana* (L.) since 1950 at Borisovka, in the Belgorod region, permitted a comparative evaluation of the infestation of the early and late varieties of the tree by this Tortricid and other insects, and the following is based on the authors' summary of the results.

In the forest-steppe region, *T. viridana* is restricted to the early variety of oak, even during mass outbreaks. Eggs are laid on both varieties, and the larvae will feed on both, but the late variety produces its leaves too late for infestation in the field. Early oaks are preferred by the first generation of *Acrocercops* (*Coriscium*) *brongniardella* (F.), and late oaks by *Cynips* (*Diplolepis*) *quercus-folii* L. and *Andricus fecundatrix* (Htg.). Parasites had little effect on *T. viridana*, and the collapse of the outbreak in 1954 was due to egg mortality in spring, probably caused by prolonged cold in April.

Komarova (O. S.). **The developmental cycle of the acorn weevil (*Curculio glandium* Marsh.) in the oak forests of the Belgorod region,** pp. 77–87, 2 graphs, 9 refs. Observations in the Belgorod region in 1949–52 showed that adults of *Curculio glandium* Marsham appear on oaks in small numbers in May, apparently having overwintered in the soil, and in greater numbers in June–July. The females oviposit in the acorns over about a fortnight in July, laying 1–10 eggs in each, though only 1–2 larvae complete their development. The larvae hatch in late July or early August, feed in the acorns and enter the soil in August or September; only the earliest larvae pupate and give rise to adults in the same autumn, the rest entering diapause for one or sometimes two years. Early oaks were more heavily infested than late ones, and development was completed 10–15 days earlier on them.

Shel'deshova (G. G.). **The biology of the pear Tortricid (*Carpocapsa pyrivora* Danil.),** pp. 88–121, 8 figs., 16 refs. *Cydia* (*Carpocapsa*) *pyrivora* (Danilevskiĭ), which has been recorded from several European countries as its synonym, *C.* (*C.*) *dannehli* (Obraztsov) [*cf. R.A.E.*, A **48** 103, etc.], occurs in the steppe and forest-steppe zones of European Russia and also in the Crimea and the Caucasus. Its distribution closely coincides with that of wild pear, and it has not been observed to the east of the Volga or in Central Asia. It is the major pest of pear in the forest-steppe region and also in the foothills and mountain regions of the North Caucasus and Dagestan, but in the Crimea and on the Black Sea coast it is less injurious to this fruit than is *C.* (*C.*) *pomonella* (L.). The life-cycle of *C. pyrivora*, which is fairly constant in different places and years, differs from that of *C. pomonella*, and there is only one generation a year. The larvae feed only on the seeds of pear at a suitable stage of maturity, which determines the dates of infestation of different varieties, and cannot develop in the fruits of seedless varieties. Infestation can be diagnosed by means of the changes that take place at the site of entry of a larva. Pupation occurs in the upper soil, and the adults cannot emerge from a depth exceeding about 2 in. Most larvae enter the soil beneath the crowns of the trees, and the overwintering population occurs mostly beneath summer–autumn varieties and early wild pears. Overwintering larvae in diapause are very resistant to cold, surviving temperatures falling to −25 or −30°C. [−13

or −22°F.], and the diapause is terminated by low temperature under the right moisture conditions. At low temperature, the larvae survive short periods of flooding. The size of the population is little affected by weather or by diseases or parasites; the parasites observed included *Pimpla turionellae* (L.), the main one, unidentified species of *Agrothereutes* (*Gambrus*) and *Mesochorus*, and *Ncoplectops* (*Craspedothrix*) *veniseta* (Stein). The control measures recommended are soil cultivation to destroy the overwintering larvae and the pupae, the destruction of fallen fruits, and the use of insecticides, notably DDT in oil emulsion, against the adults and eggs. *C. pyrivora*, unlike *C. pomonella*, seems little adapted to the conditions obtaining in cultivated orchards, and can easily be kept under control by cultural measures.

Kuznetsov (V. I.). **Zonal distribution of Lepidoptera and the formation of the fauna of forest and plantation pests in the mountains of western Kopet-Dag,** pp. 122–147, 10 refs. This is a discussion of the distribution of Lepidoptera of importance in forests and forest plantations in the Kopet-Dag mountains, in central Asia, according to altitude.

Grinfel'd (E. K.) & Issi (I. V.). **The rôle of beetles in the pollination of plants,** pp. 148–159. Upwards of 60 species of beetles that visit flowers and may be of importance in pollination are recorded from the Belgorod region of the Soviet Union, and their habits are discussed.

Aysu (R.). **Zeytin sineği biyolojisinde araştırmalar.** [Investigations on the bionomics of the olive fly.]—*Tomurcuk* **7** no. 76 pp. 15–16, 3 refs. Istanbul, 1958.

Modern methods of controlling *Dacus oleae* (Gmel.) on olive require accurate knowledge of the dates of appearance of the eggs and larvae. Observations in the Aegean region of Turkey showed that there were 3–4 generations in the comparatively unfavourable years of 1953 and 1954, but 5–6 in 1955, which was more favourable. In this last year, development lasted 30–40 days, and five generations were completed between mid-July and November–December. Oviposition begins 6–12 days after adult emergence, generally about 20th July. The larvae hatch in three days in summer and 10–12 days in autumn and pass through their three instars in 6–8, 5–6 and 5–8 days, respectively, and the pupal stage lasts up to 12 days.

Alkan (B.). **Güney Anadolu biberlerinde zarar yapan yeni bir haşere (*Asphondylia capsici* Barnes. Diptera Cecidomyidae).** [*A. capsici*, a new pest injurious to peppers in southern Anatolia.]—*Tomurcuk* **7** no. 78 pp. 8, 9, 4 refs. Istanbul, 1958. (With summaries in German & English.)

Cecidomyiids reared from larvae found causing deformation of the buds, flowers and fruits of peppers (*Capsicum annuum*) in southern Turkey in 1957 were identified as *Asphondylia capsici* Barnes. The literature on this insect is briefly reviewed.

Birkardeşler (H.). **Elma talaş kurdu** (*Hoplocampa testudinea*). [The apple sawfly, *H. testudinea*.]—*Tomurcuk* **7** no. 78 pp. 10–14, 5 refs. Istanbul, 1958.

Hoplocampa testudinea (Klug) is an important pest of apple in the Marmara region of Turkey, and all stages of this sawfly and its bionomics are described, with a note on its control.

Çakillar (M.). **Marmara Bölgesinde zeytin güvesinin biyolojisi üzerinde araştırmalar.** [Investigations on the biology of the olive moth in the Marmara Region.]—[7+] 100 [+1] pp., 20 figs., 57 refs. Istanbul, Minist. Agric., 1959. (With a summary in English.)

The author reviews the cultivation of olives in the Marmara Region of western Turkey, the literature on *Prays oleellus* (F.), the systematic position and synonymy of this Hyponomeutid and the morphology of its various stages, and records the results of investigations on its bionomics and ecology there carried out since 1949. As elsewhere [*cf. R.A.E.*, A **40** 283–284], there were three generations a year, infesting the leaves, flowering buds and fruits. Adults of the winter generation emerged from late March to late May, and those of the subsequent generations between mid-June and early July and in September–October, respectively. The females laid up to 108 eggs each, and these hatched in 9–10 days in July and 10–12 days in September. The percentage of flower buds destroyed by the larvae was 40–60, and fruit damage ranged up to 27 per cent. The larval stage lasted 8 days in the laboratory at 25°C. [77°F.] and 98 per cent. relative humidity, and the pupal stage 4–10 days, depending on season. In addition to *Ageniaspis fuscicollis praysincola* Silv., *P. oleellus* was parasitised by *Psychoda* sp., *Phytomyptera nitidiventris* Rond. and unidentified species of *Ephialtes* and *Campoplex*.

Pradhan (S.), Jotwani (M. G.) & Rai (B. K.). **Bioassay of insecticides. VIII. Relative toxicity of some insecticides to red pumpkin beetle, *Aulacophora foveicollis* Lucas (Coleoptera: Chrysomelidae).**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 104–107, 1 ref. New Delhi, 1959.

In this part of a series [*cf. R.A.E.*, A **47** 205, etc.], the results are given of laboratory tests on the toxicity to field-collected adults of *Aulacophora foveicollis* (Lucas) of fresh dried films and direct sprays of organic insecticides. Commercial preparations of pyrethrum and nicotine sulphate and emulsions prepared from the technical grades of other materials were used as previously described [*cf. loc. cit.*], and comparison of LC50's 24 hours after exposure to the films for two hours showed that γ BHC, dieldrin, endrin and parathion were nearly 171, 120, 67 and 60, diazinon, aldrin, isodrin, pyrethrum, chlordane and toxaphene about 28, 26, 21, 11, 4 and 2 and malathion and nicotine sulphate about 0·8 and 0·4 times as toxic as p,p′DDT, whereas similar comparison after direct application of sprays showed that γ BHC, parathion, dieldrin, aldrin and pyrethrum were 13·7, 7·9, 4·5, 1·7 and 0·82 times as toxic as p,p′DDT. Malathion gave only about 50 per cent. kill at 1 per cent. in a direct spray, and was the least toxic of the insecticides tested by this method.

Batra (H. N.). **Bionomics of *Bagrada cruciferarum* Kirkaldy (Heteroptera: Pentatomidae) and its occurrence as a pest of mustard seeds.**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 130–135, 3 refs. New Delhi, 1959.

The following is based largely on the author's summary. Investigations on the bionomics of *Bagrada cruciferarum* Kirk., a pest of mustard in India, carried out under natural conditions throughout the year, showed that this Pentatomid is very susceptible to changes in weather and that populations varied in accordance with the shelter available in the crop. The bugs remained under the foliage of thick, weedy or lodged crops, within

the loose folds of leaves or in soil crevices for protection against excessive cold in winter or heat in summer and migrated from crops that did not provide suitable shelter. The adults flew only when greatly disturbed. The Pentatomid was rarely found feeding under exposed conditions, and only at temperatures of 70–102°F.; it was most active at about 90°F. *B. cruciferarum* passed through several overlapping generations in the year and was most numerous on cabbage in spring. It overwintered, from September onwards, on mustard and other cruciferous crops, suffering heavy mortality during cold weather, and was found to concentrate under the harvested mustard in spring and to remain on it even when it was dry and ready to thresh. It attacked cabbage in April, cowpea, sorghum and maize in May–June, young cauliflower and cabbage as soon as they were available in June and July, and transplanted cauliflower, cabbage, early-sown turnip and radish in August. It was found to feed on dry mustard seeds on the threshing grounds and to depress the oil content considerably if allowed to do so for long. Feeding on green foliage caused silvery or pale grey spots or patches.

It is concluded that the mustard crop should be well spaced, kept free of weeds and harvested and removed from the threshing ground as soon as possible; weeds, treated with insecticides, can be left on bunds as trap crops.

Nair (M. R. G. K.). **The biology and control of a rice stalk borer,** *Proceras polychrysa* **Meyrick (Lepidoptera: Pyralidae) from Kerala.**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 136–141, 1 fig., 4 refs. New Delhi, 1959.

Chilotraea (*Proceras*) *polychrysa* (Meyr.), which was so far known only from Malaya, was found attacking rice in southern Kerala in 1955–56 and caused severe damage in 1956–58 in different localities in the Trivandrum District; *Echinochloa* (*Panicum*) *crusgalli*, a weed in rice-fields, was found to be an alternative food-plant. All stages of the moth are described. Observations showed that the females deposited up to 488 eggs each, in three days; they were laid in groups of up to 80 in rows along shallow furrows on either surface of the leaves, but mainly on the basal half. The larvae bored into the outer leaf sheath at the base of the leaf and fed in burrows in the sheaths or stem, moving to another plant if the first died or became populated by too many larvae. Pupation took place in a cell in the feeding tunnel. The egg, larval and pupal stages lasted 6, 23–36 and 4 days, respectively, in July–October. A few larvae were parasitised by *Bracon albolineatus* Cam., and a few of the pupae by *Tetrastichus* sp. The crop loss caused by *C. polychrysa* appeared to be about 60 per cent. The larvae attack the plants in all stages of growth, killing young plants within a short time and causing the formation of dead or white earheads on mature ones. In preliminary tests, spraying with 40 gal. 0·05 per cent. endrin per acre resulted in significantly larger numbers of ears than did 40 gal. 0·023 per cent. parathion or no treatment, and both insecticides reduced the average number of dead ears, though not significantly.

Agarwal (R. A.). **Occurrence of two Nitidulid beetles on sugarcane.**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 159–160, 4 refs. New Delhi, 1959.

At Coimbatore in March 1956, sugar-cane plants of numerous varieties were heavily infested by *Saccharicoccus sacchari* (Ckll.), which caused sap to ooze from them in quantities. Two Nitidulids, *Carpophilus mutilatus*

Erichs. and *Haptoncus luteolus* (Erichs.), occurred in large numbers beneath the leaf sheaths. The beetles were always associated with the mealybugs and were apparently attracted by the sap. They caused no apparent damage, and were not numerous in 1957.

Chatterji (S.) & Rahalkar (G. W.). **Biological notes on *Microphanurus* sp., a Scelionid egg parasite of *Eurydema* sp. (Pentatomidae: Heteroptera).**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 162–163, 1 fig. New Delhi, 1959.

When adults of *Eurydema* sp. collected from cauliflower at New Delhi in November 1956 were caged and supplied with fresh cauliflower leaves each day, eggs were laid but neither these nor eggs collected in the field developed, and an unidentified species of *Microphanurus* was found to be parasitising them. The parasites developed from egg to adult in 17 days at a temperature of 68–74°F. and 56 per cent. relative humidity. They mated within an hour of emergence, and though 2–4 females oviposited simultaneously in a single host egg, only one parasite matured in it. The ratio of males to females was 9 : 11.

Basheer (M.). **Observation on the usefulness of the large scale operations carried out against sugarcane borers.**—*Indian J. Ent.* **20** (1958) pt. 2 pp. 164–166. New Delhi, 1959.

As a result of severe damage to sugar-cane by the early shoot borer [*Chilotraea infuscatella* (Sn.)] and the top shoot borer [*Scirpophaga nivella* (F.)] in the Tiruchirapalli district of Madras State in March–September 1953, it was made compulsory for farmers to remove and destroy infested shoots and to spray the crop with 0·32 per cent. DDT. Surveys showed that untreated plants suffered 27·4–50 and 0·27–0·33 per cent. attack by the two insects, respectively, whereas plants that had infested shoots removed once suffered 4·1–42·8 and 0–8·62 per cent. attack when no sprays were applied and 0–19·1 and 0–7·2 per cent. when one application was made; those that had the infested shoots removed twice and were given one application of DDT had 0·8–4·8 and 0–1·6 per cent. of the shoots attacked.

Rajan (S. V.). **The hairy caterpillar pest of cardamom.**—*Mysore agric. J.* **33** no. 2 pp. 71–75, 3 refs. Bangalore, 1958.

Cardamom (*Elettaria cardamomum*) in India is attacked by several insect pests, of which the most important are *Taeniothrips cardamoni* Ram. Ayyar, which sometimes caused 30–60 per cent. loss of crop, and *Eupterote canaraica* Moore, outbreaks of which occur at intervals, the last of a serious nature occurring in Mysore and Coorg in 1953–54 [*cf. R.A.E.*, A **45** 142]. The adults of this Eupterotid emerge in June–August. The eggs are laid in clusters of 100–130 on the lower surfaces of the leaves of shade trees, and the larvae feed on these until the second moult, after which they descend and feed on the leaves of the cardamom plants, sometimes defoliating them completely. Pupation begins in late December, the pupae being found in a variety of sheltered situations near or in the soil. There is only one generation a year, and the egg, larval and pupal stages last 8–12 days, nearly 132 days and 7–8 months, respectively. For control, the

larvae can easily be induced to drop into basins of kerosene and water or killed by sprays of insecticides, details of which are given [*cf. loc. cit.*] and the pupae can be collected and destroyed. The larvae are attacked by *Beauveria bassiana* on some estates, and this fungus should be disseminated where it does not already occur. They also have a few insect parasites, which are being studied.

Joseph (K. V.). **Preliminary studies on the seasonal variation in starch content of bamboos in Kerala State and its relation to beetle borer infestation.**—*J. Bombay nat. Hist. Soc.* **55** no. 2 pp. 221–227, 2 graphs, 4 refs. Bombay, 1958.

The contents of starch in bamboos felled in Kerala were found to average 9·6 per cent. in July–August, 13·63 in April–June and September–November, 16·04 in December, January and March and 19·02 in February, and the intensity of attack on the felled bamboos by borers (*Dinoderus minutus* (F.) and *Minthea rugicollis* (Wlk.)) was found to be positively correlated with the starch content. Minimum attack is ensured by felling in July–August.

Menon (K. D.). **Defoliation of an experimental pulpwood plantation.**—*Malay. Forester* **21** no. 4 pp. 230–235. Kuala Lumpur, 1958.

A plantation of over 40 acres of *Albizia falcata* in Malaya was defoliated by *Eurema hecabe contubernalis* (Moore) early in 1957 and by *Semiothisa emersaria* (Wlk.) early in 1958. In both years, the attack began after a spell of comparatively dry weather. The life-histories of these Lepidoptera are reviewed, and details are given of work on their control by means of DDT aerosols generated by a Swingfog machine [*cf. R.A.E.*, A **42** 393]. These proved very effective against the larvae of both insects. The mixture used contained 1 part of a 25 per cent. solution of DDT in miscible oil and 3 parts diesel oil.

Chu (H. F.) & Meng (H. L.). **Studies on three species of cotton plant-bugs, *Adelphocoris taeniophorus* Reuter, *A. lineolatus* (Goeze), and *Lygus lucorum* Meyer-Dür (Hemiptera, Miridae).** [*In Chinese.*]—*Acta ent. sin.* **8** no. 2 pp. 97–118, 27 figs., 28 refs. [Peking] 1958. (With a summary in English.)

Observations in 11 provinces of China showed that 17 species of bugs injure cotton there. Of these, the most important are three Mirids, *Adelphocoris taeniophorus* Reut., *A. lineolatus* (Goeze) and *Lygus lucorum* (Meyer), and investigations on these were made in 1953–55. Damage begins while the plants are in the seedling stage, when the terminal buds are punctured and the plants retarded in growth. Later, feeding on both terminal and lateral buds leads to shedding of fruiting forms and a bushy growth; holes are also formed in the leaves. A method of rearing the bugs in the laboratory was developed, after initial difficulties had been overcome and it had been established that a supply of honey or aphids was required as supplementary food. Winter is passed in the egg stage, in scars on tree trunks by *A. taeniophorus* and in lucerne stems and other sites by the other two. The eggs of *A. taeniophorus* hatch in early May, and those of the others in early April, and the bugs migrate to cotton after feeding on other plants. *A. taeniophorus* has 1–2 generations a year,

A. lineolatus 3–4 and *L. lucorum* 3–5. The ecology of the bugs is briefly reviewed. They prefer shady damp sites, and the adults are attracted to flowers. They are attacked by numerous predators, including spiders, and the eggs are parasitised by *Anagrus* sp., *Telenomus* sp. and *Polynema* sp., which afford considerable control, as also does dusting with BHC. All stages of the bugs are described.

Chang (Hsüeh-tsu), Chow (Shao-lai) & Wang (Yung-jen). **A preliminary study on the codling moth in Sinkiang.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 2 pp. 136–151, 2 pls., 4 refs. [Peking] 1958. (With a summary in English.)

Cydia (*Carpocapsa*) *pomonella* (L.) has recently been found infesting apple and pear in Sinkiang [*cf. R.A.E.*, A **47** 268] and causes considerable damage there. Observations at Kurla in 1953 and 1956 showed that there are three generations a year, though the second and third are only partial, the peaks of emergence of adults of the overwintering and first generations occurring in early May and mid-July, respectively. The females laid up to 91 eggs each, mostly on the upper leaves and fruits, and the larvae of the first and second generations hatched in 4–13 and 3–10 days and pupated after 27–39 days. Apple was mostly infested by larvae of the first generation and pear by those of the later ones, and infestation was heaviest in the upper parts of the trees. Of the parasites present, *Trichogramma* sp. was the most important; it parasitised up to 44 per cent. of the eggs on apple and 5·3 per cent. of those on pear. An emulsion spray of 0·2 per cent. DDT applied five times between 1st May and 26th July gave 84·3 and 100 per cent. mortality of young larvae on pear and apple, respectively, in 15 days and reduced the percentages of fruits infested at harvest from over 43 to less than 16 for pear and from over 75 to less than 27 for apple; thorough application to pear reduced the percentage to less than 5. Supplementary measures of value are the use of cloth bands treated with 15 per cent. DDT in fuel oil round the trunks, the best times for applying these being the end of May on apple and the beginning of July on pear, and the removal of fallen or rejected fruits from the orchard.

Blake jr. (G. H.), Eden (W. G.) & Hays (K. L.). **Residual effectiveness of chlorinated hydrocarbons for control of the imported fire ant.**—*J. econ. Ent.* **52** no. 1 pp. 1–3, 7 refs. Menasha, Wis., 1959.

Experiments were carried out in Alabama in 1953–58 on the control of *Solenopsis saevissima* var. *richteri* Forel, which has spread rapidly over the south-eastern United States in the last few years. When broadcast in granules on permanent sod lands in late winter or early spring, 2 lb. heptachlor or dieldrin and 4 lb. chlordane per acre were highly effective immediately and gave good control for 3–5 years; after their effect had disappeared, the mounds were more numerous but smaller on treated than on untreated areas. In one test, 2 lb. dieldrin per acre was effective for a longer period in granules than in an emulsion spray. Lower dosages of the insecticides gave good control for one year, but not longer, and dieldrin and heptachlor granules gave about the same degree of control when mixed with fertiliser as when used alone. A 10 per cent. chlordane dust applied to the mounds and the ground round them killed the ants in the mounds, but did not prevent reinfestation. When applied by aeroplane at the rate of 2 lb. technical material per acre, granules containing 5 and 10

per cent. heptachlor were equally effective for one year. The effect of 2 lb. heptachlor, dieldrin or aldrin and 4 lb. chlordane per acre in granules was not affected by soil type (clay or sandy loam); aldrin was slightly less effective than the other materials.

EIDE (P. M.). **Soil fumigation to control weevil grubs in strawberries.**—*J. econ. Ent.* **52** no. 1 pp. 3–5, 3 refs. Menasha, Wis., 1959.

Aldrin or heptachlor is incorporated into the surface layer of soil in most strawberry plantings in western Washington, to protect the plants from weevils of the genus *Otiorhynchus* (*Brachyrhinus*), but these compounds, and also dieldrin, chlordane and DDT, had no effect on *Nemocestes incomptus* (Horn), which is a fairly common weevil there and appeared in large numbers in one field in 1954–55. A commercial bait containing sodium fluosilicate destroyed the adults almost completely, but later permitted severe damage to the plants by their progeny.

Attempts were made at two places in 1956–57 to kill the larvae in the soil. Two fumigants, ethylene dibromide and Nemagon (1,2-dibromo-3-chloropropane) were injected at depths of 4 and 6 in., and two water-soluble toxicants, trichlorphon (Dipterex) and Vapam (sodium methyldithiocarbamate), were sprinkled on to the soil in water. The results indicated that, when applied only to the rows, ethylene dibromide gives practical control of *N. incomptus*, *Sciopithes obscurus* Horn, *O.* (*B.*) *sulcatus* (F.) and *O.* (*B.*) *ovatus* (L.) at doses as low as 1·6 U.S. gal. per acre; it was most effective at about 4 U.S. gal. and did not injure the plants at 8 U.S. gal. per acre. The depth of application did not affect control, and staggering the points of injection to give more even coverage did not improve it; there was some indication that diluting it with kerosene was advantageous. Plants treated by early May, when signs of damage were first observed, recovered rapidly and bore a good crop, whereas those treated in June did not recover. Neither Nemagon (a nematicide) nor trichlorphon showed promise, and Vapam killed the plants in a few days.

BIBBY (F. F.). **Notes on aphids, Psyllids and whiteflies of Arizona.**—*J. econ. Ent.* **52** no. 1 pp. 6–9, 5 refs. Menasha, Wis., 1959.

A list is given of 32 species of aphids in 15 genera, six Psyllids in five genera, and eight Aleyrodids in six genera collected in Arizona in 1953–58, with their food-plants, collection records and sometimes notes on habits, abundance and other matters of interest, including parasitism.

GAST (R. T.). **Laboratory studies of residual contact effect of 28 insecticides on Japanese beetle adults.**—*J. econ. Ent.* **52** no. 1 pp. 9–12, 3 refs. Menasha, Wis., 1959.

Adults of *Popillia japonica* Newm. caused severe damage to soy bean, sweet maize and apple trees in parts of North Carolina in the summer of 1957, and 28 organic compounds were tested for toxicity to them. Emulsion concentrates were diluted with water and applied in a spray tower to give known deposits in petri dishes, and the beetles were exposed to the deposits after various periods. The LD50's of materials showing good residual effect were determined by exposing beetles to fresh deposits of four concentrations. Only deposits of Sevin, Guthion, endrin, DDT, DDD

(TDE) and methoxy-DDT (methoxychlor) remained toxic for more than nine days, and these had LD50's of 0·042, 0·051, 0·11, 0·25, 1 and 1·6 μg. per sq. cm., respectively. Deposits of Sevin and Guthion at 2·5–10 μg. per sq. cm. and methoxy-DDT at 5–10 μg. remained effective for 35 days. Beetles were affected within an hour by methoxy-DDT, and some were killed within four hours by Sevin and Guthion; DDD, DDT and endrin were much slower in action, requiring 10–20 hours to become effective, and also had a much shorter residual life. Phosdrin and RE-4355 (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate) gave complete kills within five minutes when freshly applied, but rapidly lost their effectiveness.

Mathis (W.) & Schoof (H. F.). **The effectiveness of dieldrin against the rice water weevil.**—*J. econ. Ent.* **52** no. 1 pp. 14–16, 1 graph, 7 refs. Menasha, Wis., 1959.

The temporary draining of rice-fields in Mississippi for the control of *Lissorhoptrus oryzophilus* Kuschel favours heavy production of mosquitos of the genus *Psorophora*, and a chemical treatment that would control both insects is desirable. In the course of tests on the control of the mosquito larvae in 1952 [*R.A.E.*, B **45** 193], 0·5 and 1 lb. dieldrin in 3 and 5 U.S. gal. emulsion spray per acre, respectively, applied by aeroplane before the initial flooding, almost completely eliminated the weevil during the 9–10 weeks of testing from rice-fields 48–100 acres in extent. In small-plot tests, very good control was given by preflood treatment with 0·25–0·75 lb. dieldrin in 20 U.S. gal. spray per acre, applied by power sprayer, or with 1 lb. dieldrin per acre in 5 per cent. pellets, and also by sowing flooded plots by hand with seeds that had been pregerminated by immersion in water for 24 hours and storage under a tarpaulin for 24 hours, after which they were mixed with wettable dieldrin powder at a rate to give 1 lb. actual compound per acre [*cf.* A **46** 341].

Blum (M. S.), Earle (N. W.) & Roussel (J. S.). **Absorption and metabolism of DDT in the boll weevil.**—*J. econ. Ent.* **52** no. 1 pp. 17–20, 16 refs. Menasha, Wis., 1959.

The following is based on the authors' abstract. In laboratory studies of the tolerance of DDT by *Anthonomus grandis* Boh., adults were treated topically or by injection and the rate of penetration and metabolism of the DDT determined. The weevil showed a natural tolerance for the compound, applied topically, which varied with the strain and age of the insect and the time of year. Overwintered weevils were more sensitive than those of the first generation, and weevils resistant to endrin were slightly more resistant to DDT than those susceptible to endrin. Both resistant and susceptible weevils were very susceptible to injected doses of DDT, indicating that the relative inactivity after topical application was due to failure to reach the site of action. The rates of penetration were equal in susceptible and resistant weevils treated topically, about 60 per cent. of a dose of 5 μg. being absorbed in 48 hours. Small amounts of DDT were found in both strains, but slightly more in the susceptible insects; DDE was produced in trace quantities in both strains, but no DDA was recovered, and about 40 per cent. of the applied DDT was converted into unknown metabolites after 48 hours. Topically applied DDE and DDA were recovered in large amounts from resistant weevils, indicating that neither is an important intermediate in DDT metabolism in *A. grandis*. The

toxicity of DDT to the weevil increased as the temperature fell [*cf. R.A.E.*, A **45** 313], and the addition of equal quantities of 1,1-di(p-chlorophenyl)-ethane or 1,1-di(p-chlorophenyl)-2,2,2-trifluoroethanol, which are effective synergists for DDT in *Musca domestica* L. [*cf.* B **41** 75; **45** 1], made it only 3–5 times as toxic to *A. grandis*.

Arthur (B. W.) & Casida (J. E.). **Biological activity and metabolism of Hercules AC-528 components in rats and cockroaches.**—*J. econ. Ent.* **52** no. 1 pp. 20–27, 3 graphs, 15 refs. Menasha, Wis., 1959.

Although elemental analysis indicated that technical Hercules AC-528 closely approximates to 2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate), eight different fractions, the composition of which is discussed, were obtained when it was subjected to partition chromatography. Two of these, referred to as the *cis* and *trans* isomers of 2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate), formed 68·3 per cent. of the whole by weight and contained 23·5 and 49·7 per cent. of the total phosphorus, respectively. Toxicity to *Musca domestica* L. and rats, anticholinesterase activity and stability to alkaline hydrolysis were studied for all eight fractions, and the metabolism of the *cis* and *trans* isomers and of two of the minor components, 2-p-dioxene S-(O,O-diethyl phosphorodithioate) and bis-(diethoxyphosphinothioyl) disulphide, in rats and *Periplaneta americana* (L.) was investigated by the use of ^{32}P-labelled materials.

The *cis* isomer proved the most toxic, the LD50 for *M. domestica* 24 hours after topical application in acetone being 7 mg. per kg. body weight, and that for rats after injection in maize oil being 65 mg. per kg.; the corresponding amounts for the *trans* isomer were 21 and 240 mg., and those for technical AC-528 15 and 95 mg. The *cis* and *trans* isomers were the most stable of the fractions in an alkaline medium, stability being about equal for the two. Anticholinesterase activity *in vitro* was least for the *cis* and *trans* isomers and the dioxene component. Observations on cholinesterase depression and recovery in rats after administration of sublethal doses of technical AC-528 are recorded; the cholinesterase depression was much greater with the technical material than with the *cis* isomer at a proportionate rate.

In the studies on metabolism, the *cis* and *trans* isomers were found to be the most stable of the radioactive compounds in rats, in *P. americana*, and in various *in vitro* biological systems. The hydrolysis products recovered *in vivo* and *in vitro* were O,O-diethyl phosphoric, O,O-diethyl phosphorothioic and O,O-diethyl phosphorodithioic acids. There was evidence that AC-528 accumulates to a small degree in the fat of rats, but the residues disappeared rapidly when feeding with the material was discontinued.

Hall (I. M.) & Dunn (P. H.). **The effect of certain insecticides and fungicides on fungi pathogenic to the spotted alfalfa aphid.**—*J. econ. Ent.* **52** no. 1 pp. 28–29, 6 refs. Menasha, Wis., 1959.

Hall (I. M.) & Halfhill (J. C.). **The germination of resting spores of *Entomophthora virulenta* Hall and Dunn.**—*T.c.* pp. 30–35, 2 figs., 8 refs.

Parathion, malathion and demeton have been recommended for the control of *Therioaphis maculata* (Buckt.) on lucerne in California, and the investigations described in the first paper were carried out to determine the

effect of these, DDT, Trithion and a number of fungicides on the five entomogenous fungi that afford important control of the aphid in many areas [*cf. R.A.E.*, A **46** 491, etc.]. The insecticides and fungicides were incorporated in agar, and this was inoculated with the fungi and maintained at about 25°C. [77°F.] for ten days, after which fungus growth was examined. All the insecticides killed *Entomophthora exitialis*, the best and the most widely distributed of the fungi, all but parathion killed *E. obscura* and *E. ignobilis*, and all but parathion and DDT killed *E. virulenta*, but only Trithion prevented the growth of *E. coronata*. *E. exitialis* was the most and *E. coronata* the least affected by the fungicides.

As insecticides are applied mainly when conditions are unfavourable for the fungi, tests were made in which resting spores of *E. virulenta* were soaked in insecticide solutions for about six hours before being resuspended in water and sown on agar plates. None of the insecticides killed the spores, though they retarded germination to some extent, and it is concluded that viability would be maintained in the field despite repeated insecticide applications. If the other fungi react in the same way, it is possible that the insecticide programmes recommended for the suppression of *T. maculata* will not reduce the fungi that attack it.

The following is virtually the authors' abstract of the second paper. Laboratory tests showed that about 2–5 per cent. of the resting spores of *E. virulenta* from pure cultures are ready to germinate when removed from the dry state and placed on artificial media. The germinating spores do not need the influence of chitin-splitting micro-organisms or a lengthy period in a moist environment in order to start growth, but they are responsive to conditions of high humidity, since a progressive increase in germination was noted as the period for which the spores were soaked was increased. Considerable germination was noted after 10-minute exposures to temperatures up to 93°C. [199·4°F.], but no growth occurred after a 96-hour exposure to 85°C. [185°F.].

Tuttle (D. M.) & Wene (G. P.). **Early season cotton thrips control in the Yuma, Arizona area.**—*J. econ. Ent.* **52** no. 1 pp. 35–36, 3 refs. Menasha, Wis., 1959.

The control of thrips on cotton early in the season is recommended in parts of Arizona, where the altitude is more than 1,500 ft. above sea level and there is a relatively short growing season, and field experiments were made in 1954–57 to determine the effect of similar control on cotton yields near Yuma, where the altitude is less than 700 ft. and there is an extended growing season; although thrips have seldom occurred on seedling cotton in injurious numbers in this area, they were thought possibly to be of some importance. The predominant species was *Frankliniella occidentalis* (Perg.), and populations were higher in 1954 than in 1955–57. Plots were sown with about 21 lb. delinted seed per acre. The results showed that none of the treatments caused a significant increase in yield. In 1954, 0·5 lb. toxaphene, 0·75 lb. dieldrin and 1 lb. heptachlor in 3 U.S. gal. spray per acre gave poor thrips control, even when applied twice, so that some resistance to chlorinated hydrocarbons appeared to have developed, but 0·75 lb. malathion caused significant reductions in population. When applied to the seeds in 1955 or 1956, 0·5–0·8 lb. phorate (Thimet), 0·5 lb. Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] and 0·8 lb. Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] per acre in a carbon powder formulation gave good control for 22–24 days after the plants appeared, but 0·1 lb. demeton or schradan in

water solution and 0·5 lb. chlordane or γ BHC in slurries were ineffective. In 1957, treatment of the seeds with phorate or Bayer 19639 in powder or emulsion form resulted in no difference in control due to formulation, but the effect of phorate persisted for longer.

Skoog (F. E.). **Systemic insecticides as seed and granular treatments to prevent grasshopper damage to margins of winter wheat.**—*J. econ. Ent.* **52** no. 1 pp. 37–41, 2 figs., 18 refs. Menasha, Wis., 1959.

Tests were made in Montana in 1956–57 to ascertain whether seed treatment with phorate (Thimet) or Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] could be used to protect wheat seedlings growing at the edges of fields from attack by grasshoppers.

In a preliminary laboratory test, seeds treated with 0·25 or 0·5 lb. phorate per 100 lb., applied in an activated-carbon dust with an adhesive, were sown in pots and the seedlings repeatedly infested with nymphs or adults of *Melanoplus bivittatus* (Say) to approximate a continuous infestation of at least one insect per foot of row. Phorate at the higher rate killed all insects in three days until 15 days after sowing and in longer periods thereafter, but at the lower rate began to lose effect after ten days. The latter did not prevent plant damage, but the former protected the plants for up to 27 days after sowing, after which damage increased until growth had been reduced by about 75 per cent. after 48 days. Comparison of phorate and 19639 at 0·5 and 1 lb., respectively, per 100 lb. seed with the same quantities applied per acre in granules at seed depth showed that all treatments gave complete mortality of introduced grasshoppers in three days for four weeks and in ten days during the fifth week. Germination was materially reduced by both seed treatments, but not by the granules.

In a field test, untreated seed and seeds treated with 0·44 lb. phorate per 100 lb. were sown on 19th April 1956, and laboratory-reared adults of *M. bilituratus* (Wlk.) caged over the seedlings when these appeared. After three days, the plants from untreated seed had been eaten to the ground, but those from treated seed were 2–3 in. high and showed no significant damage; grasshopper mortality averaged 6·25 and 55 per cent., respectively. After eight days, plants from treated seed were 3–4 in. high and all grasshoppers on them were dead, whereas practically all the others had been completely destroyed and there was 38 per cent. mortality of grasshoppers on them. Treatment of seed with 0·5 lb. phorate per 100 lb. before sowing in September 1956 killed grasshoppers, mainly *M. bilituratus*, attacking the seedlings and permitted good recovery of these after 27 days. Seedlings from untreated seed were severely injured but not killed.

Blinn (R. C.), Carman (G. E.), Ewart (W. H.) & Gunther (F. A.). **Residual behavior of various insecticides on and in lemons and oranges.**—*J. econ. Ent.* **52** no. 1 pp. 42–44, 1 graph, 3 refs. Menasha, Wis., 1959.

In tests in California to determine the magnitude and persistence of residues of chlordane, dieldrin and heptachlor on lemons and of malathion on Valencia oranges, full-coverage sprays from wettable powders were applied and mature fruits picked at intervals thereafter and analysed. The residues of chlordane, dieldrin, heptachlor and malathion in the peel averaged 15, 31·4, 8·4 and 1·5 parts per million, respectively, seven days after the application of sprays containing 2, 1, 1 and 0·75 lb. actual

compound per 100 U.S. gal., and had half-lives of 19, 60, 15 and 32 days, respectively. The residues found in the pulp were negligible.

Wressell (H. B.) & Driscoll (G. R.). **Granulated insecticides for control of the European corn borer in southwestern Ontario.**—*J. econ. Ent.* **52** no. 1 pp. 49–51, 8 refs. Menasha, Wis., 1959.

Several insecticides were compared with an emulsified solution of DDT for the control of *Pyrausta nubilalis* (Hb.) on sweet maize in Ontario. They were applied three times at weekly intervals with a hand shaker in 1956, beginning at the early- or mid-whorl stage, and plants receiving 0·5 lb. endrin or 1·5 lb. heptachlor per acre in granules yielded over 95 per cent. marketable ears, whereas those treated with 1·5 lb. DDT in emulsion spray or granules or 1·5 lb. toxaphene in granules yielded 80, 73 and 62 per cent. and untreated plants 2 per cent. marketable ears. DDT in either treatment reduced the numbers of larvae by 86 per cent., and the other compounds did so by over 90 per cent.

In 1957, a commercial machine was used to apply granules, the plants were treated three times, beginning at the mid-whorl stage, and 1 lb. heptachlor, 0·3 lb. endrin and 1·5 lb. trichlorphon (Dipterex) per acre in granules reduced the numbers of larvae by over 90 per cent. and 1·5 lb. DDT in emulsion spray and 1 lb. DDT in granules did so by 87 and 84 per cent., respectively. The percentages of marketable ears were over 90 for the first three compounds, 90 for the DDT spray, 85 for the DDT granules and 14 for no treatment.

Strong (R. G.) & Lindgren (D. L.). **Effect of methyl bromide and hydrocyanic acid fumigation on the germination of wheat.**—*J. econ. Ent.* **52** no. 1 pp. 51–60, 7 graphs, 8 refs. Menasha, Wis., 1959.

The following is substantially the authors' abstract. Two varieties of stored wheat, with a graded moisture range of 8, 10, 12 and 14 per cent., were fumigated with methyl bromide or hydrogen cyanide in gas-tight chambers, 100 cu. ft. in capacity. Exposure periods, dosages of fumigant and temperatures during fumigation were varied, and half the samples received one fumigation and the others two. Two series of germination tests were made, the first within five days after fumigation and the second after storage at 50°F. for 84 days.

Under the conditions used, the germination of wheat was not affected by fumigation with HCN, but methyl bromide retarded seedling emergence and growth of roots and shoots, in degrees ranging up to complete absence of germination. It is thought that differences between the two varieties with respect to germination after fumigation with methyl bromide were attributable to seed quality rather than to true differences in susceptibility to the fumigant. Increases in dosage (up to 6 lb. per 1,000 cu. ft.), temperature (up to 90°F.), period of exposure (up to 72 hours) and moisture content of the seed contributed to decreases in germination after fumigation, and the results illustrated the interdependence of these factors in contributing to seed injury from fumigation with methyl bromide. A second fumigation increased any injury caused by the first but did not initiate damage. No significant differences were observed between the percentages of germination or of living seeds immediately after fumigation and after post-fumigation storage.

Reynolds (H. T.), Anderson (L. D.) & Andres (L. A.). **Cultural and chemical control of the lesser cornstalk borer in southern California.**—*J. econ. Ent.* **52** no. 1 pp. 63–66, 7 refs. Menasha, Wis., 1959.

In California, *Elasmopalpus lignosellus* (Zell.) tunnels in the stems of maize, sorghum, beans and other agricultural crops, primarily in the south-eastern desert areas, but occasionally in the southern coastal areas, and most wild grasses are important food-plants that help to maintain its population. Injury to crops is confined almost entirely to seedlings and arises primarily from the migration of larvae already present on other plants at the time of sowing rather than from freshly deposited eggs. The most effective cultural control therefore consists in destroying infested plants in the field some weeks before sowing. Irrigation can also be used to reduce the population on some crops enough to ensure satisfactory plant stands.

Insecticides are ineffective after the larvae have become established in the plants, but can be used to prevent attack. In tests in 1956–57, mostly on sorghum, they seemed rather more effective when applied immediately after the plants had appeared than when used at sowing time. They did not give good results on sorghum sown for flood irrigation, in which the seeds were drilled a few inches apart, but were very effective in beds sown in rows at a spacing of 40 in., indicating that, for a given amount of toxicant per acre, concentrating the insecticide in bands a few inches wide along the rows is the most effective method of application. When applied in this way at about 8 oz. toxicant per acre, dieldrin, endrin, heptachlor and aldrin in granules and the first two in emulsion sprays caused excellent reductions in the numbers of plants damaged, with no significant difference between granules and sprays. Thiodan at 19 oz. and dieldrin at 4 oz. per acre in sprays and dieldrin at 1·4 oz. in granules gave some control but were much less effective.

Flanders (S. E.). **The employment of exotic entomophagous insects in pest control.**—*J. econ. Ent.* **52** no. 1 pp. 71–75, 1 fig., 28 refs. Menasha, Wis., 1959.

The following is substantially the author's abstract. In order that an exotic entomophagous insect may establish itself when colonised in a new country, it must frequent the habitat of the host species at a time when the susceptible stages of the host are present. Establishment is most likely when the colonisations are numerically adequate and are placed in contact with susceptible host populations that are not regressing. Effective entomophagous insects are usually derived from the native habitat of the host, provided that the host in that habitat exists at low population densities. The dominant entomophagous species obtained under such conditions is likely to be the most effective, particularly if it is host specific. Importations should be made from representative types of host environments, since no one species of entomophagous insect is likely to be effective throughout the range of its host. After establishment, artificial exposure of host populations provides a means of demonstrating the effectiveness of the entomophagous insect, but where two or more are concerned, evaluation may be difficult, because the species responsible for the reduction of high host densities may not be the species responsible for the maintenance of the host populations at the average level of steady density.

These principles are illustrated from work on the establishment of introduced insect parasites and predators in various parts of the world, but

chiefly in California, where some 80 species or races of parasitic Hymenoptera were colonised in 1934–54 and 20, a list of which is given, became established.

Miskus (R.), Tzanakakis (M. E.) & Smith (S. M.). **Determination of Bayer 19639 residues in agricultural crops by cholinesterase inhibition.** —*J. econ. Ent.* **52** no. 1 pp. 76–78, 2 graphs, 4 refs. Menasha, Wis., 1959.

Attempts to determine residues of Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] on crops by measuring cholinesterase inhibition proved unsatisfactory, as the compound is not a strong inhibitor in its pure state, but a method was developed by which it was oxidised with a mixture of hydrogen peroxide and acetic acid to form a more active inhibitor, which could successfully be measured. Details are given of the apparatus, reagents and methods used. A standard curve is prepared by oxidising a stock solution containing 10 μg. of the compound per ml., determining cholinesterase inhibition for suitable aliquots and plotting percentage inhibition against dosage on semi-logarithmic paper. Plant samples are chopped and shaken with chloroform, the extract dehydrated, aliquots of the samples oxidised and tested for cholinesterase inhibition, and the content of 19639 estimated by comparison with the standard curve.

Acree jr. (F.), Beroza (M.), Holbrook (R. F.) & Haller (H. L.). **The stability of hydrogenated gypsy moth sex attractant.**—*J. econ. Ent.* **52** no. 1 pp. 82–85, 7 refs. Menasha, Wis., 1959.

The sex attractant extracted from the abdominal tips of unfertilised females of *Lymantria* (*Porthetria*) *dispar* (L.) [*cf. R.A.E.*, A **43** 50, etc.] remains effective for six weeks when fresh, but deteriorates rapidly thereafter, even when refrigerated, and is far less attractive to males during the next flight season. Attempts to stabilise the material, so that it could be collected in advance and stored, were made by repeatedly introducing hydrogen into a flask containing the extract and a catalytic slurry of platinum oxide in ethyl acetate, the flask being evacuated between the introductions of gas, until no more hydrogen was taken up. The hydrogenated extract was warmed, diluted with benzene, filtered and stored at 4°C. [39·2°F.] until needed. Extracts that were collected and hydrogenated between 1947 and 1956 were tested at intervals to determine the loss of attractiveness, and no differences were found in the effect of materials collected 1–9 years before use, provided that hydrogenation had been carried out soon after collection.

Riehl (L. A.) & Wedding (R. T.). **Relation of oil type, deposit, and soaking to effects of spray oils on photosynthesis in *Citrus* leaves.**—*J. econ. Ent.* **52** no. 1 pp. 88–94, 18 refs. Menasha, Wis., 1959.

The following is based on the authors' abstract. The effect of varying the hydrocarbon composition and the molecular size of spray oils on the inhibition of photosynthesis in *Citrus* leaves and their recovery with time after treatment was investigated in California. Known deposits of oil were applied in emulsion sprays to potted, single-leaf, rooted stem cuttings in the greenhouse by means of a spraying tower, and measurements made up to 21 days later showed no consistent inhibition of photosynthesis of Eureka

lemon or Bearss lime leaves from deposits of 150 μg. California light-medium or medium-grade spray oils per sq. cm. of leaf surface, which are sufficient for the control of *Aonidiella aurantii* (Mask.) and *Panonychus citri* (McG.). The plants were not exposed to the ultraviolet components of sunlight, but investigations on the leaves of trees sprayed in the field indicated that ultraviolet light is not an important factor affecting photosynthesis after the application of oil sprays. There was a definite relation between inhibition of photosynthesis and increasing oil deposit for deposits in the range of 300–600 μg. oil per sq. cm., but the data showed that the response to small increments of oil would be slight. Recovery of photosynthesis occurred sooner in plants treated with naphthenic than in those treated with paraffinic oil sprays.

The principal reduction of photosynthesis occurred in the tissue of the leaf marked by the dark discoloration known as oil soaking, where there was 50–60 per cent. inhibition during the first week after application. When such leaves were immersed in a 1 per cent. aqueous solution of 2,3,5-triphenyl tetrazolium chloride and kept in the dark, a red colour developed, showing that the cells of the discoloured tissue had not been killed. Inhibition of photosynthesis appeared to be due to interference with gaseous exchange as a result of the presence of the oil. Dissipation of the oil was accompanied by a recovery in photosynthesis.

Benjamini (E.), Metcalf (R. L.) & Fukuto (T. R.). **The chemistry and mode of action of the insecticide O,O-diethyl O-p-methylsulfinylphenyl phosphorothionate and its analogues.**—*J. econ. Ent.* **52** no. 1 pp. 94–98, 1 graph, 18 refs. Menasha, Wis., 1959.

O,O-Diethyl O-p-methylsulphinylphenyl phosphorothioate (Bayer 25141), a yellowish liquid of boiling point 138–141°C. soluble in most organic solvents but not in water, is an outstanding insecticide against certain pests [*cf.* next abstract]. When it was exposed on leaves or glass in the open for 14 days, it was slowly oxidised and isomerised to give small quantities of O,O-diethyl O-p-methylsulphonylphenyl phosphorothioate (which is also known as an insecticide), O,S-diethyl O-p-methylsulphinylphenyl phosphorothioate and O,S-diethyl O-p-methylsulphonylphenyl phosphorothioate. A trace of the reduction product, O,O-diethyl O-p-methylthiophenyl phosphorothioate, was also produced, and when the original compound was heated to 140°C. for seven hours in a sealed tube, it underwent internal oxidation-reduction to give 27 per cent. of this product and a total of about 64 per cent. of the other derivatives. In a similar test, the dimethyl analogue, O,O-dimethyl O-p-methylsulphinylphenyl phosphorothioate [Bayer 25198], was less stable to heat, more than half being lost after 30 minutes and all after seven hours; there was 21·5 per cent. of the O,S-dimethyl ester after 30 minutes and almost 100 per cent. after seven hours, when sulphides and sulphones that had been formed during the interval had disappeared.

When O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate labelled with ^{32}P was applied topically to living adults of *Periplaneta americana* (L.) or incubated with their guts *in vitro* for four hours, analysis of the metabolites showed that similar oxidation and isomerisation products were formed; as they were found to possess enhanced anticholinesterase activity, they apparently contribute to the mechanism of toxic action. The reaction of the dialkyl-substituted aryl phosphates with cholinesterase is bimolecular, and the activities of the three O,O-diethyl phosphorothioate compounds and the corresponding phosphates in inhibiting brain cholinesterase of the

house-fly [*Musca domestica* (L.)] and the rate constants for the reaction between these compounds and the brain cholinesterase were determined manometrically. These constants and the rates of hydrolysis, determined by ultraviolet spectrophotometry, were satisfactorily correlated with the electron-withdrawing capacities of the aryl substituents.

Benjamini (E.), Metcalf (R. L.) & Fukuto (T. R.). **Contact and systemic insecticidal properties of O,O-diethyl O-p-methylsulfinylphenyl phosphorothionate and its analogues.**—*J. econ. Ent.* **52** no. 1 pp. 99–102, 1 fig., 7 refs. Menasha, Wis., 1959.

In tests in which adults of *Musca domestica* L. and *Periplaneta americana* (L.) and larvae of *Spodoptera* (*Laphygma*) *frugiperda* (J. E. Smith) were treated topically and adults of *Panonychus* (*Metatetranychus*) *citri* (McG.), *Tribolium confusum* Duv. and *Brevicoryne brassicae* (L.) exposed to deposits on oranges, filter paper and cabbage leaves, respectively, O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate (Bayer 25141) was more toxic than O,O-diethyl O-p-methylsulphonylphenyl or O,O-diethyl O-p-methylthiophenyl phosphorothioate, the last being the least effective against all but the mite. Diethyl p-methylsulphinylphenyl phosphate was more toxic than diethyl p-methylsulphonylphenyl and diethyl methylthiophenyl phosphate to the house-fly and mite; furthermore, the phosphates were superior to the phosphorothioates against these two. The sulphinyl compounds were of the same order of contact toxicity as parathion. O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate had an LD50 of 20–25 mg. per kg. when injected into mice, as compared with 20–24 mg. for parathion, and was less toxic to the house-fly and more so to the other test species than O,O-dimethyl O-p-methylsulphinylphenyl phosphorothioate.

When the O,O-diethyl esters were applied as systemic insecticides against *Aphis gossypii* Glov. to the base of cotton stems at 5 µl. per plant, the three phosphates were more effective than the corresponding phosphorothioates and the thiophenyl and sulphinylphenyl compounds than the sulphonylphenyl ones, which were apparently too polar to penetrate the plant cuticle and may be so unstable as to hydrolyse rapidly to inactive products in the plants. The rate of accumulation of ^{32}P in cotton leaves after stem application of labelled materials showed that O,O-dimethyl O-p-methylsulphinylphenyl phosphorothioate was absorbed and translocated more rapidly than was O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate but less so than O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate (Bayer 19639), whereas the last was the least rapidly hydrolysed. Paper chromatography indicated that O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate is oxidised to the sulphonylphenyl compound and apparently isomerised to O,S-diethyl isomers in plant tissue [*cf.* preceding abstract], chiefly within the leaf, where the reactions are catalysed enzymatically or hydrolytically.

Lindquist (D. A.), Fairchild (M. L.), Dahm (P. A.) & Gurland (J.). **Thiodan residues on corn plants.**—*J. econ. Ent.* **52** no. 1 pp. 102–106, 22 refs. Menasha, Wis., 1959.

The dissipation of residues of Thiodan, applied to maize plants 3–4 ft. high for the control of *Pyrausta nubilalis* (Hb.), was investigated in Iowa in 1957. The insecticide was applied at 1·5 lb. in 10 U.S. gal. emulsion spray or at 1 lb. in 20 lb. granules per acre on 26th–29th June, and plant samples taken 1–65 days later were chopped and the extracts from them

analysed by titration for organic chlorine, by colorimetric determination of evolved sulphur dioxide and by bioassay with adult females of *Musca domestica* L. The three methods are described in detail and their value discussed. The spray resulted in much higher initial residues than did the granules, but there was little difference a week after application; small but detectable residues were still present nine weeks after both treatments.

Thomas jr. (C. A.) & Chamberlain (W. F.). **Response of the pea aphid to chemical repellents.**—*J. econ. Ent.* **52** no. 1 pp. 106–109, 1 graph, 4 refs. Menasha, Wis., 1959.

Tests were carried out in South Carolina in 1956–57 to determine the effect of various factors on the repellency of certain compounds to *Macrosiphum pisum* (Harris) in an olfactometer and on lucerne in the field. Methyl pentanone, camphene, 10-undecenoic acid and p-dichlorobenzene all gave fair or good results in the olfactometer, lasting for 40 minutes and 4·5, 0·5 and 2·5 hours, respectively. The first two were more repellent to the apterae and p-dichlorobenzene to the alates, whereas 10-undecenoic acid showed little difference. Results varied with the different materials, but concentration and the length of exposure of the treated surface to the air stream had the greatest effect on repellency. Field counts were not made until 24 hours after the application of the materials, usually at 10 lb. per acre, in dusts to plants one foot high, and no reduction in population was observed.

Dustan (G. G.) & Chisholm (D.). **DDT residues on peach in Ontario.**—*J. econ. Ent.* **52** no. 1 pp. 109–110, 4 refs. Menasha, Wis., 1959.

In an experiment carried out in the Niagara Peninsula of Ontario in 1957, different numbers of DDT sprays were applied to mature peach trees, the last one 25 days before harvest. It was found that two applications of 2 lb. 50 per cent. wettable DDT per 100 gal. on 4th and 15th July and one of 1 lb. per 100 gal. on 22nd August, as recommended for the control of *Cydia* (*Grapholitha*) *molesta* (Busck), left a residue about 30 per cent. below the official tolerance of 7 parts DDT per million at harvest. The inclusion of three earlier sprays on 27th May and 5th and 17th June, as applied by a few growers, who add DDT for the control of *C. molesta* to the sprays against the curculio [*Conotrachelus nenuphar* (Hbst.)] and make a special application against *Lygus lineolaris* (P. de B.), increased the residue to about 60 per cent. above tolerance, but including the three early sprays and omitting the last reduced it to below tolerance. The last spray alone left a residue of about a quarter of the permitted tolerance at harvest, and it is concluded that an interval of 25 days between the last spray and harvest of peaches is adequate in Ontario if the regular schedule of three DDT sprays is adopted.

Casida (J. E.). & Ahmed (M. K.). **Mechanism of residue loss of Hercules AC-528 components on plant foliage.**—*J. econ. Ent.* **52** no. 1 pp. 111–116, 12 refs. Menasha, Wis., 1959.

The following is substantially the authors' abstract. Technical Hercules AC-528 is a mixture of the *cis* and *trans* isomers of 2,3-p-dioxane S,S-bis-(O,O-diethyl phosphorodithioate) and certain other phosphorodithioates [*cf. R.A.E.*, A **48** 215]. In tests, loss of its components from plants

resulted from volatilisation, hydrolysis and the formation of more polar derivatives and more potent anticholinesterase agents. The *cis* and *trans* isomers were similar in persistence, so that residue loss did not change their ratio from that in the original material, and no conversion occurred in the plants between the *cis* and *trans* isomers and 2-p-dioxene S-(O,O-diethyl phosphorodithioate), which is an impurity in the technical insecticide. The components of AC-528 were hydrolysed only slowly on the plant surface but rapidly when absorbed. The conversion of several of them to more polar derivatives and more potent anticholinesterase agents when applied to plants may have been partly due to the formation of phosphorothiolate derivatives, but attempts at chemical oxidation of certain components to yield these were only partly successful. Dunn's analytical method [**47** 156] determines only the *cis* and *trans* isomers and fails to detect the several components of the technical compound and certain non-hydrolysed derivatives formed from them after application to plants, and the toxicological significance of the organophosphates that are present in residues of AC-528 on crops, but are not determined by Dunn's method, cannot be fully evaluated with the limited data given.

Schuster (M. F.). **A pepper-flower bud worm,** *Gnorimoschema gudmannella* **(Wlsm.).**—*J. econ. Ent.* **52** no. 1 pp. 117–118, 3 refs. Menasha, Wis., 1959.

Gnorimoschema gudmannella (Wlsm.), which was first observed in the United States in 1944, has become one of the major pests of cultivated peppers in the Lower Rio Grande Valley of Texas since the autumn of 1956, when larvae were found feeding within the flower buds of all varieties of *Capsicum annuum*, including several wild ones, on which populations were maintained through the summer and winter. Observations showed that the larva feeds on the style, anthers and ovary within the bud and usually causes it to drop. The extent of damage depends on the earliness of the attack, which is related to the distance of the crop from infested wild peppers; it increased as the season progressed, so that some fields had all buds infested by July and all fields showed some infestation by October. In the laboratory, at 78–82°F. and 67–73 per cent. relative humidity, the egg, larval, prepupal and pupal stages lasted 3–4, 7–13, 2 and 7–10 days, adult males and females lived for 13–35 and 7–35 days and the preoviposition and oviposition periods were 9–19 and 4–22 days, respectively. Mated females deposited 58–292 eggs in an average of 11·5 days, whereas unmated ones did not oviposit. In the field, the egg, larval and pupal stages lasted 4–7, 14–24 and 11–21 days, and three generations and a partial fourth were completed between November 1956 and March 1957. Two Braconid parasites, *Chelonus phthorimaeae* Gah. and an undescribed species of *Orgilus*, emerged from the pupae at about the expected date of moth emergence; *Orgilus* attacked up to 30 per cent. of the larvae in October and November 1956.

Lichtenstein (E. P.) & Schulz (K. R.). **Breakdown of lindane and aldrin in soils.**—*J. econ. Ent.* **52** no. 1 pp. 118–124, 4 figs., 11 refs. Menasha, Wis., 1959.

In investigations in Wisconsin, a muck soil, a silt loam and a sandy loam were treated in the field with 10 or 100 lb. lindane [almost pure γ BHC] or 2, 20 or 200 lb. aldrin per acre in emulsion sprays in May 1954 and tilled

to a depth of 4–5 in. Samples of the silt loam were also treated in the laboratory with γ BHC and aldrin at 10 parts per million, and soil from both experiments was analysed at intervals by chemical methods and by bioassay with adults of *Drosophila melanogaster* Mg , exposed directly to the soil by a method already noticed [*R.A.E.*, A **46** 436], to obtain information on the fate of the insecticides.

With the silt loam treated with γ BHC in the laboratory, the two methods gave similar estimates of the quantity present initially, but the results were only 66 per cent. as great for bioassay as for chemical analysis after 2–8 weeks, and similar results were obtained with the silt and sandy soils three years after the field treatments; the proportion had dropped to 46 per cent. for the sandy soil after 3·5 years. It is concluded that the γ BHC was slowly converted to a non-toxic substance. In the silt and sandy soils treated with aldrin in the field, bioassay showed 1·7–5·22, 1·4–13·4 and 1·26–7·3 times as much toxicant after 2, 3 and 4 years, respectively, as did chemical analysis, indicating conversion to a more toxic compound, which proved to be dieldrin [*cf.* **47** 252, etc.]. After four years, relatively more dieldrin was found in the sandy loam and less in the muck soil than in the silt loam, and conversion increased as the rate of application fell. In the laboratory, 3–5 per cent. of the insecticide detected in the silt loam was dieldrin after 28–84 days at 7°C. [44·6°F.], but at 26 and 46°C. [78·8 and 114·8°F.], the proportions increased to 22 and 44 per cent., respectively, after 56 days, and then fell to 16 and 35 per cent. after 84 days.

Lichtenstein (E. P.) & Schulz (K. R.). **Persistence of some chlorinated hydrocarbon insecticides as influenced by soil types, rate of application and temperature.**—*J. econ. Ent.* **52** no. 1 pp. 124–131, 5 graphs, 26 refs. Menasha, Wis., 1959.

In tests in Wisconsin, a silt loam (containing 3·8 per cent. organic matter) and a muck soil (40 per cent. organic matter) were treated in the field in May 1954 with 10 or 100 lb. DDT or lindane [almost pure γ BHC] or 20 or 200 lb. aldrin per acre, as already described [*cf.* preceding abstract], and samples were collected at once and after 6–42 months and analysed chemically for insecticide residues. At the lower rates of application, 33 per cent. of the DDT and γ BHC and 4·7 per cent. of the aldrin originally applied were detected in the muck soil and 22·7, 3·9 and 1·1 per cent., respectively, in the loam after 3·5 years, the rate of loss being highest during the first six months; the percentages were 2·0, 3·5 and 2·27 times as great for DDT, γ BHC and aldrin at the higher rate in the loam soil. Similar results were obtained at 46°C. [114·8°F.] in the laboratory, where the percentage detected after 56 days was 2·2 times as great in loam treated with aldrin at a rate equivalent to 200 lb. per acre as in that treated at 20 lb. At 26 and 6°C. [78·8 and 42·8°F.], this difference disappeared, and there was about 56 and 84 per cent. recovery of aldrin at 20 lb. in loam, 51 and 73 per cent. of heptachlor at 20 lb. in loam and 38 and 63 per cent. of aldrin at 100 lb. in sand after 56 days. No losses of insecticide occurred in frozen soils.

Watters (F. L.). **Effects of grain moisture content on residual toxicity and repellency of malathion.**—*J. econ. Ent.* **52** no. 1 pp. 131–134, 1 fig., 4 refs. Menasha, Wis., 1959.

When adults of *Cryptolestes* (*Laemophloeus*) *ferrugineus* (Steph.) were exposed for one week to wheat that had been treated with malathion and

stored for various periods in airtight containers at 48°F., 2 and 16 parts insecticide per million gave 99 per cent. mortality after eight months in grain containing 13·5 and 15·5 per cent. moisture, respectively, but neither treatment was effective after five months in wheat containing 18 per cent. moisture. In adjoining samples of treated and untreated wheat containing 12, 15 or 17 per cent. moisture, *L. ferrugineus* was repelled by 4 p.p.m. malathion in wheat containing 12 per cent. moisture, but both this species and *Sitophilus granarius* (L.) were apparently attracted in that containing 17 per cent. moisture and *S. granarius* by 8 p.p.m. malathion at all moisture levels. Both doses gave generally high mortality of both species in the untreated as well as the treated sections, suggesting that malathion may be effective in wheat that has been unevenly treated. In spite of 56–97 per cent. mortality of *Sitophilus* in one week in the sections unevenly treated with 4 p.p.m., reproduction did not differ significantly from that in untreated wheat, in which there was up to 6 per cent. mortality, but uneven treatment with 8 p.p.m. increased mortality to 67·2–100 per cent. and reduced reproduction significantly. Mortality of *Laemophloeus* reached 31–97·5 and 67·7–100 per cent. in wheat unevenly treated with 4 and 8 p.p.m., respectively, but reproduction was very low in both treated and untreated sections. Malathion at these rates had no adverse effect on the milling or baking qualities of the wheat.

Fye (R. E.), McMillian (W. W.) & Hopkins (A. R.). **Time between puncture by the boll weevil and fall of the punctured cotton square.**—*J. econ. Ent.* **52** no. 1 pp. 134–136, 2 refs. Menasha, Wis., 1959.

Since losses of cotton due to *Anthonomus grandis* Boh. would be minimised if punctured squares were retained by the plant and produced lint of good quality, or, alternatively, dropped early and were replaced, tests were carried out in 1956 and 1957 to determine whether three varieties grown in the coastal section of South Carolina have either of these characteristics. The results showed no differences in the period for which punctured squares remained on the plants, which averaged 11–13 days, regardless of the number of punctures and whether they were made for feeding or for oviposition; 20 per cent. of the punctured squares produced usable lint. Treating the plants with gibberellic acid appeared to increase the number of punctured squares retained on one variety.

van den Bosch (R.), Schlinger (E. I.), Dietrick (E. J.), Hagen (K. S.) & Holloway (J. K.). **The colonization and establishment of imported parasites of the spotted alfalfa aphid in California.**—*J. econ. Ent.* **52** no. 1 pp. 136–141, 2 figs., 13 refs. Menasha, Wis., 1959.

During 1955 and 1956, two Braconids, *Praon palitans* Mues. and *Trioxys utilis* Mues., and *Aphelinus semiflavus* How. were introduced into California, reared in the laboratory and liberated for the control of *Therioaphis maculata* (Buckt.) on lucerne [*cf. R.A.E.*, A **46** 231]. The initial liberations were made in the late summer and autumn of 1955, when relatively small numbers of parasites were released in commercial fields. No recoveries were made, and permanent colonisation plots were then established, some of which were repeatedly stocked with parasites. Recoveries were made in some of these in 1956, but most of the colonies were lost in that year because of insecticide treatment of the plots and the surrounding areas, depletion of aphid populations by predacious Coccinellids or fungus diseases,

or the mowing and grazing, and in some cases ploughing under, of the lucerne.

A five-acre plot over which control could be exercised was then found in an area of 38 acres of lucerne at Lancaster; an acre in the middle of it was left uncut, and a large cage, to exclude Coccinellids, was set up in this and the parasites, and extra aphids, periodically released into it; cutting of the rest of the plot was staggered. All three parasites were used, and the cage was opened in mid-June, when they had become well established, to permit spread. This occurred at a time when the aphid population was increasing rapidly and Coccinellids were at a minimum, and the parasites spread rapidly over the plot and out into the surrounding area, which had received no insecticides. The Braconids became very numerous by the beginning of September, and the transfer of freshly cut lucerne, bearing numerous parasitised aphids, to several areas in southern California resulted in establishment of the parasites there. Subsequent distribution from these resulted in even further spread later in the year. As this process was laborious, a mechanical collector, mounted on a truck, was developed. When this was driven through a lucerne field, insects were knocked into a scoop and drawn into collecting sacks by a rotary fan. Parasites and parasitised aphids were drawn through a coarse mesh to separate them from larger organisms and débris, and it is estimated that more than 100 million were collected and transferred to other local fields or used for mass release at a distance, which resulted in the establishment of parasites in all the major lucerne-growing areas of California during 1957. The parasites had spread naturally from several foci by the end of the year, but the three species differed in distribution. The range of each is described and shown on a map, and it is shown that *P. palitans* spread most rapidly and covered the widest area and that *A. semiflavus* was the least abundant and least important. Parasites had been established in about a million acres of irrigated lucerne and were playing an increasingly important part in the control of the aphid by the end of 1957.

VAN DEN BOSCH (R.), SCHLINGER (E. I.), DIETRICK (E. J.) & HALL (I. M.). **The role of imported parasites in the biological control of the spotted alfalfa aphid in southern California in 1957.**—*J. econ. Ent.* **52** no. 1 pp. 142–154, 6 graphs, 8 refs. Menasha, Wis., 1959.

The following is substantially the authors' abstract. Observations were made in 1957 to evaluate the importance of *Praon palitans* Mues., *Trioxys utilis* Mues. and *Aphelinus semiflavus* How., which had been introduced into southern California against *Therioaphis maculata* (Buckt.) on lucerne [*cf.* preceding abstract], in comparison with predacious Coccinellids and fungus disease (caused principally by *Entomophthora exitialis*) in the control of the aphid. Single fields in three distinct climatic areas were used. The aphid was under heavy biotic pressure in all three fields over most of the year, reaching economic abundance only once at Cawelo and Lancaster and not at all at Calexico. Coccinellids appeared to give the most control in all three fields, and disease was of major importance at Calexico. Parasitism reached high levels at certain times and contributed significantly to control in each area, but the harvesting process appeared to have an adverse effect on the parasites, particularly in midsummer, and periodic invasion of the fields by large numbers of alate aphids had an unfavourable effect on the ratio of parasite to host. The parasites showed varying climatic adaptation, *P. palitans* being dominant at Cawelo and Lancaster and *Trioxys* at Calexico; *A. semiflavus* was encountered in fair abundance only at Cawelo.

Schlinger (E. I.) & Hall (J. C.). **A synopsis of the biologies of three imported parasites of the spotted alfalfa aphid.**—*J. econ. Ent.* **52** no. 1 pp. 154–157, 9 refs. Menasha, Wis., 1959.

The introduced *Praon palitans* Mues., *Trioxys utilis* Mues. and *Aphelinus semiflavus* How. are the only insect parasites known to attack *Therioaphis maculata* (Buckt.) on lucerne in California, unless the introduced form of *A. semiflavus* proves to differ from the native one. They appear to have some 20 or more generations a year, are solitary internal parasites, and have equal numbers of males and females. The known hosts of the first two are all of the genus *Therioaphis* and include *T. trifolii* (Monell) and *T. riehmi* (Börn.); the imported form of *A. semiflavus* has been reared from these and *Myzus persicae* (Sulz.), whereas the native form has been recorded from 12 species of aphids in seven genera. All attack all stages of *T. maculata*, but *Praon* prefers the older nymphs and adults, *Trioxys* nymphs in the first three instars and *Aphelinus* those in the first two; *P. palitans* is the only one that readily attacks the adults, including the alates, and this may account for its more rapid spread. Most of the population of *P. palitans* is in diapause as mature larvae in cocoons during November–March, but the other species do not appear to enter a true diapause, though development may cease during the colder months. All three are attacked by secondary parasites, *Pachyneuron siphonophorae* (Ashm.) and *Asaphes californicus* Gir. ovipositing through the cocoons and *Aphidencyrtus aphidivorus* (Mayr) and four species of *Charips* ovipositing in living aphids containing parasite eggs or larvae.

The egg of *Praon palitans* is usually laid in the abdomen of the host and hatches in about 72 hours. The host dies about two days later, when the larva has moulted twice, and the parasite then constructs a cocoon outside it. The prepupal and pupal stages and complete development last 1–2, 4–5 and 11–13 days, respectively. Unmated females produce only males. *Trioxys utilis* deposits up to four eggs in one host, but only one parasite matures. The egg hatches in about 48 hours, and the larval, prepupal and pupal stages and complete development last about 2–3, 1, 4–5 and 9–11 days, respectively, the host dying towards the end of the larval stage of the parasite. Pupation takes place within the dead host. *Trioxys* seems to survive better than *Praon* at high temperatures.

The bionomics of the American form of *Aphelinus semiflavus* have been studied in detail [*R.A.E.*, A **11** 164]. Both mated and unmated females of the introduced form produce offspring of both sexes, the sex ratio apparently depending to some extent on temperature. The egg is deposited in the host and hatches in about 72 hours, and the host dies 3–4 days later. The prepupal and pupal stages and complete development last 1, 5–6 and 11–13 days, respectively.

Armitage (H. M.). **Aromatic bait traps as a factor in insect spread.**—*J. econ. Ent.* **52** no. 1 pp. 157–158. Menasha, Wis., 1959.

The following is based on the author's abstract of this general discussion. Aromatic bait-traps, as used in insect surveys, do not trap all the insects they attract, and may therefore be responsible for establishing new centres of infestation. To prevent this, each trap should be situated so that its attractive range is well outside that of any other; traps should be placed well away from the food-plants of the insects concerned but within attractive range of them, the amount of lure used should be calculated so as to permit the maximum attractive range without being repellent at the

source, and areas adjacent to traps should be kept under continuous treatment with effective, non-attractive insecticides. These principles are illustrated by reference to field work, notably that concerned with the surveys for the Mediterranean fruit-fly [*Ceratitis capitata* (Wied.)] in Florida [*cf. R.A.E.*, A **45** 259].

Nielson (M. W.) & Henderson (J. A.). **Biology of *Collops vittatus* (Say) in Arizona, and feeding habits of seven predators of the spotted alfalfa aphid.**—*J. econ. Ent.* **52** no. 1 pp. 159–162, 4 refs. Menasha, Wis., 1959.

In laboratory tests on *Collops vittatus* (Say) in Arizona in June–September 1957, the egg stage averaged 5·5 days, the five larval instars 8, 5·8, 13, 12·2 and 14·3 days and the prepupal and pupal stages 3·2 and 8·5 days, respectively. Females laid one or more clusters of about 40 eggs each. In lucerne fields, larvae of all instars but the first were numerous in débris and humus, but none was found in the soil or on the plants. They appeared to feed on small living or larger dead insects. Adults were present throughout the year, but were most abundant in May–October, mainly on foliage, but occasionally on the ground. They fed on *Therioaphis maculata* (Buckt.) and other insects and appeared to oviposit under débris, though a few eggs were found on the lucerne leaves [*cf. R.A.E.*, A **46** 335–336].

In laboratory tests in which adults received constant diets of 5–40 examples of *T. maculata* a day, those receiving 20 lived longest; starved females lived twice as long as starved males. When supplies were not limited, females usually ate more than males, and the numbers consumed by both sexes tended to increase with rising temperature. Observations on the feeding habits of this and other predators of *T. maculata* indicated that the average numbers of aphids destroyed per adult per day were 97, 35 and 34 by *Hippodamia convergens* (Guér.), *C. vittatus* and *Zelus renardii* Kol. and 29, 24, 22 and 5 by *Geocoris punctipes sonoraensis* Van D., *Sinea confusa* Caudell, *Nabis ferus* (L.) and *Orius tristicolor* (White). The effect of sex and time of day on the feeding capacity of the various predators is discussed.

Warren III (F. W.) & King (D. R.). **The biotic effect of insecticides on populations of aphids and mites of pecans.**—*J. econ. Ent.* **52** no. 1 pp. 163–165, 7 refs. Menasha, Wis., 1959.

In investigations in Texas, pecan trees that were lightly infested by *Monellia costalis* (Fitch) on 14th May were treated with an emulsion spray containing 1·5 lb. DDT per 100 U.S. gal. on 21st May. There was an initial decrease in the infestation, followed by an increase, and the aphid population was twice as great by 11th June as on unsprayed trees, after which it declined until the numbers were comparable. A second application was made on 19th June, and this was followed by an outbreak of *Eotetranychus* (*Tetranychus*) *hicoriae* (McG.) between 16th July and 27th August, when unsprayed trees were not heavily infested [*cf. R.A.E.*, A **45** 274]. The factors contributing to the development of large populations of aphids and mites on sprayed pecan trees were therefore investigated.

Predators appeared to have little effect in maintaining populations at uninjurious levels, and were not affected by insecticides. When batches

of *M. costalis* were caged on DDT-sprayed and unsprayed leaves on the same tree at weekly intervals, sprayed leaves killed all aphids until five weeks after treatment, and in a test with one sprayed and one unsprayed tree, populations of *M. costalis*, *Melanocallis caryaefoliae* (Davis) and *E. hicoriae* became relatively large on the former and remained low on the latter but remained equal on leaves confined in bags, indicating that aphids and mites were not stimulated to a greater reproductive potential by a physiological response of the tree to DDT. When *Monellia* was sprayed with DDT and caged on unsprayed leaves, there was no survival, and complete mortality was obtained whenever the aphids were put on freshly sprayed surfaces. It is therefore considered unlikely that aphid reproduction is stimulated by DDT. Under field conditions, a DDT spray gave complete mortality of the two aphids and of *E. hicoriae* and *Oligonychus viridis* (Banks), but *E. hicoriae* was present after a week in numbers comparable with those found before treatment, probably because the eggs had not been affected; a second application destroyed the infestation.

Much greater establishment of aphids and mites was observed on trees with highly pubescent leaves than on those with smooth ones, and populations of *Monellia* were greater not only after spraying with DDT but also after dusting with an inert material. It thus appears that mechanical factors, such as pubescence or surface residue, significantly influence the development of infestations.

Frost (S. W.). **Insects caught in light traps with new baffle designs.**—*J. econ. Ent.* **52** no. 1 pp. 167–168, 1 fig., 1 ref. Menasha, Wis., 1959.

The effect of replacing the intersecting aluminium baffles of the standard Pennsylvania light-trap [*cf. R.A.E.*, A **46** 223] by a cylindrical baffle made of two thicknesses of cellulose acetate or by a four-sided prism of plexiglas was tested at State College, Pennsylvania, during the summer of 1957. There were considerable reductions in the numbers of the insects caught, which are listed, particularly in the trap with the cellulose-acetate baffle. As tests indicated that the two plastic materials probably transmitted only 55 and 75–90 per cent. of the ultraviolet rays, the decreased transmission of light, rather than the change in construction, may have been responsible for the reductions.

Frings (H.) & Frings (M.). **Notes on rearing the moths, *Cisseps* (*Scepsis*) *fulvicollis* (Hbn.) and *Ctenucha virginica* (Charp.), in the laboratory.**—*J. econ. Ent.* **52** no. 1 pp. 168–169, 2 refs. Menasha, Wis., 1959.

Cisseps fulvicollis (Hb.) has a life-cycle of about five weeks. Adults kept in wide-mouthed U.S. gallon jars and supplied with water, sugar solution and grass, lived for 20–30 days, and the females oviposited on the grass blades from 3–6 days after emergence. *Dactylis glomerata* and *Phleum pratense*, cut and stored in the refrigerator until needed, were used to feed the larvae, which pupated on the grass or the side of the jar. The egg, larval and pupal stages lasted 5–8, 22–30 and 6–10 days at 18–23°C. [64·4–73·4°F.], and 11 generations were reared between 7th August 1955 and 4th January 1957. The adults were also successfully kept in screen cages.

Ctenucha virginica (Charp.) was reared by the same method at the same time, but only two generations were produced between June 1955 and May 1956, the egg, larval and pupal stages lasting 4–8, 140–200 and 16–20

days, respectively, at laboratory temperatures. The adults lived for about a month in captivity, and eggs were laid within a day or two of emergence.

Tashiro (H.) & Tuttle (E. L.). **Carbon disulphide fumigation of the European chafer.**—*J. econ. Ent.* **52** no. 1 pp. 171–172. Menasha, Wis., 1959.

Experiments on the effectiveness of fumigation with carbon bisulphide in eliminating the soil-inhabiting stages of *Amphimallon majalis* (Razoum.), to satisfy quarantine regulations, were carried out at Geneva, New York, in 1956–57. Wooden boxes, 18 in. square and 18 in. deep, were lined with plastic sheeting or kraft paper, filled with friable soil containing one stage of the insect and covered with plastic sheeting or wet paper immediately after the fumigant had been poured into a central hole. The eggs were treated at soil temperatures of 66–74°, larvae at 32–60°, and pupae and adults above about 60°F., and all were transferred to untreated soil after 48 hours. Examination of eggs at intervals for three weeks, of larvae and pupae immediately and after 24 hours and of adults immediately and after 48 hours showed that doses of 0·5 and 0·75 lb. carbon bisulphide per cubic yard killed all the adults and all the pupae, respectively, and one of 1 lb. all the eggs and third-instar larvae at temperatures above 45°F. There was no difference in susceptibility between the sexes. From these results, the compound is recommended for the treatment of potting soil subject to infestation by *A. majalis*.

Dorst (H. E.). **Laboratory tests with insecticides against** *Drosophila melanogaster*.—*J. econ. Ent.* **52** no. 1 p. 172, 9 refs. Menasha, Wis., 1959.

Insecticides have given only moderate control of species of *Drosophila* attacking fruits and vegetables grown for processing [*cf. R.A.E.*, A **45** 277, 427, 439; **46** 345], and about 40 materials were therefore tested as contact insecticides against adults of *D. melanogaster* Mg. in the laboratory in Utah in 1955–57. The flies were confined in cartons each containing a 6-in. piece of wood bearing a fresh or weathered insecticide deposit, and preliminary experiments showed that emulsions had better residual effect than suspensions and that the laboratory strain of *D. melanogaster* used was about as susceptible as a local wild strain. With emulsions, complete mortality was given in 24 hours by fresh deposits from 2 per cent. sprays of 21 of the materials; those of heptachlor and dieldrin continued to be highly effective for about 30 days, those of dichlorvos (DDVP) for 22, those of Dow ET-57 [purified O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate], endrin and dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate for 17, and those of isodrin, aldrin, parathion, dicapthon, malathion and diazinon for ten. Chlordane, BHC and lindane [almost pure γ BHC] gave complete mortality and Trithion, phorate (Thimet), Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] and trichlorphon (Dipterex) more than 90 per cent. after three days, but TEPP and demeton were less persistent. In further tests, malathion and diazinon remained effective for 7–10 days at 1 per cent. and for 3 and 7 days, respectively, at 0·5 per cent., BHC and γ BHC for 3–5 days at 1 per cent. and heptachlor for 21, 10 and 7 days at 1, 0·5 and 0·25 per cent., respectively.

Becker (W. B.). **Further tests with BHC emulsion sprays to keep boring insects out of pine logs in Massachusetts.**—*J. econ. Ent.* **52** no. 1 pp. 173–174, 1 ref. Menasha, Wis., 1959.

Experiments on the value of BHC emulsion sprays in protecting unseasoned pine logs from beetles that bore in the wood or bark, made earlier in central Massachusetts [*R.A.E.*, A **44** 119], were repeated in other parts of the State in 1955. Logs of *Pinus strobus*, sawn from trees blown down in September 1954 at Pembroke, a little north of Cap Cod, were being attacked by *Ips* (*Pityogenes*) *hopkinsi* (Swaine), and logs of *Pinus strobus* and *P. resinosa*, felled during the winter in the hills at Pelham, by *I. hopkinsi* and *Dendroctonus valens* Lec., when they were sprayed at the beginning of May. Healthy pitch pines (*P. rigida*) were felled in June at East Sandwich, near the coast of Cape Cod, and sawn and sprayed the same day. Examination in the autumn showed that unsprayed logs were attacked by numerous species. One application of 0·4 per cent. γ BHC gave 97·5–100 per cent. protection against wood-borers and 99·2–100 per cent. protection against species that bore in the bark and cambium, except in one instance at Pembroke, where it gave only 53 per cent. protection against *Pissodes approximatus* Hopk. One application of 0·2 per cent. γ BHC at Pelham and East Sandwich gave 84–100 and 93·9–100 per cent. protection against the two groups, respectively. The results thus substantially confirmed those obtained in the earlier test.

Riehl (L. A.). **Influence of water phase of oil spray on photosynthesis in Eureka lemon and Bearss lime leaves.**—*J. econ. Ent.* **52** no. 1 pp. 174–175, 3 refs. Menasha, Wis., 1959.

As oils must be applied to *Citrus* in dilute aqueous emulsions in order to give coverage adequate for pest control without exceeding a safe amount of oil deposit, several oils (with emulsifiers) were applied as sprays to lemon and lime directly and in emulsion, to determine whether the water phase of the latter influences the effect of the oils on photosynthesis in the leaves. The oils used and the experimental procedure were the same as in previous work [*R.A.E.*, A **48** 220], and no real differences were apparent between the calculated values of mean percentage inhibition of photosynthesis for the oils applied in the two forms.

Tsao (C. H.). *Bucculatrix gossypiella*—**a potentially important pest of cotton.**—*J. econ. Ent.* **52** no. 1 p. 175, 3 refs. Menasha, Wis., 1959.

Bucculatrix gossypiella Morrill [*cf. R.A.E.*, A **15** 394, 542] was found attacking cotton in a half-acre cage at Brownsville, Texas, in September 1957 and caused serious damage to bolls, leaves and stems during the next month. A total of 722 larvae emerged from 50 infested bolls collected during October; 90 per cent. of these transformed to adults, and none was parasitised. Sprays of 0·5 lb. Guthion, CP-7769 (hexaethyl ethylthiomethylidynetriphosphonate) or Chipman R-6200 (amiton toluene-p-sulphonate) and of 2 lb. DDT with 0·5 lb. dieldrin per acre were applied against cotton pests in the cage at intervals of 5–7 days in August and September, and five and six of these applications reduced the percentages of bolls infested by *B. gossypiella* from 72 to 35, 25, 25 and 5 and from 95 to 45, 45, 40 and 15, respectively. Infested bolls were damaged very lightly on the plot treated with the mixture and very heavily on the untreated plot.

This is held to be the first record of this moth in the United States, since it is considered uncertain whether Clark's reference [**18** 67] concerned *B. gossypiella* or *B. thurberiella* Busck.

Hardison (J. R.), Krantz (G. W.) & Dickason (E. A.). **DDT injury on red fescues.**—*J. econ. Ent.* **52** no. 1 p. 176, 9 refs. Menasha, Wis., 1959.

The authors describe a conspicuous reddening of long duration observed in western Oregon in 1956–58 on several varieties of *Festuca rubra* that had been treated with 1 lb. DDT in 27 U.S. gal. emulsion spray per acre in April or May. The treatment caused no apparent injury to various other grasses, and *F. rubra* var. *commutata* was not injured by emulsion or wettable-powder sprays containing other organic insecticides. When DDT was applied at 0·5–2 and 0·5–1 lb. per acre in wettable-powder and emulsion sprays, respectively, injury increased with the dosage of DDT and became evident within two weeks. At 1·25 lb. per acre in a 5 per cent. dust, DDT caused similar injury in three weeks.

Evans (R.). **Notes on the biology of the Asiatic oak weevil in Maryland.**—*J. econ. Ent.* **52** no. 1 p. 177, 2 refs. Menasha, Wis., 1959.

Investigations on the method of overwintering of *Cyrtepistomus castaneus* (Roel.), which attacks oak and chestnut in Maryland [*cf. R.A.E.*, A **45** 442, etc.], were carried out from October 1957 to July 1958. On 20th October, groups of adults were put in boxes containing soil, forest litter and a small oak seedling, and the boxes were buried in the forest, with only the mesh-covered top above ground. They were dug up at intervals, and living adults were found in November, December and February, but not in April; some dead adults were found in all boxes. In soil samples, taken round the base of seedlings of white oak [*Quercus alba*] in an infested area in November–July, larvae, but no adults, were recovered from 1st December to 14th June, though numbers were relatively small in May and June, and a single adult was found on 1st December on boards painted with adhesive and hung in the trees. Examination of oak seedlings revealed no adults by 28th June, but several on 14th July, and it is concluded that *C. castaneus* overwinters in the soil in the larval stage, pupation probably occurring in May and June.

Beard (R. L.). **Sick milkweed bugs.**—*J. econ. Ent.* **52** no. 1 pp. 177–178. Menasha, Wis., 1959.

The author describes a pathological condition found in laboratory cultures of *Oncopeltus fasciatus* (Dall.) in Connecticut. It occurred sporadically and unpredictably, mainly in nymphs in the fourth and fifth instars, and appeared to develop most often in late summer and during periods of high humidity, even among bugs bred at constant temperature and with some degree of humidity control, and among insects living under crowded conditions. Mortality was high. Some bugs remained healthy in almost all affected cultures, and there was no consistent pattern suggesting a genetic basis. No evidence of infection could be found, and the general effect suggested an upset water metabolism. The symptoms are described.

Henneberry (T. J.), Smith (F. F.) & Taylor (E. A.). **Movement of flower thrips through greenhouse ventilators.**—*J. econ. Ent.* **52** no. 1 p. 179, 2 refs. Menasha, Wis., 1959.

In 1953, roses and chrysanthemums in greenhouses at Beltsville, Maryland, were protected from infestation by *Frankliniella tritici* (Fitch) by covering the side ventilators with screens and applying an emulsion or suspension spray of 0·25 lb. dieldrin or heptachlor per 100 U.S. gal. to the latter once a week [*cf. R.A.E.*, A **46** 94]. Malathion aerosols, applied every 7–10 days, eliminated the existing infestation in screened, but not in unscreened houses, indicating that the insects entered through the side ventilators.

Trap cards, coated with adhesive, were used in 1957 and 1958 to detect the movements of the thrips. Of those caught at the top, most were taken entering on the west side and leaving on the east, in accordance with the prevailing wind, but equal numbers were taken entering and leaving, so that screens on the top ventilators are apparently of little value. Fewer were taken entering through the side ventilators, but many of these apparently remained to infest the plants.

Catches on trap cards placed about an inch from the inner and outer sides of a cooling pad of wet excelsior, through which air was drawn by a fan, indicated that the thrips could pass through such pads and supported observations in commercial greenhouses that they do not prevent the entry of insects.

Barnes (M. M.). **Relationships among pruning time response, symptoms attributed to grape bud mite, and temporary early season boron deficiency in grapes.**—*Hilgardia* **28** no. 7 pp. 193–226, 16 figs., 29 refs. Berkeley, Cal., 1958.

Forms of abnormal growth on spur-pruned vinifera grapes in California, formerly attributed to the bud-inhabiting strain of *Eriophyes vitis* (Pgst.) [*R.A.E.*, A **39** 447], were found to be related to the effects of pruning time on time of leafing and to early-season boron deficiency and to occur in the absence of the bud mites.

Mallis (A.). **Handbook of pest control. The behavior, life history, and control of household pests.**—3rd edn., 9¼ × 6 in., 1132 pp., 238 figs., many refs. New York, N.Y., MacNair-Dorland Co., 1960. Price $12.50 in U.S.A.; $13 elsewhere.

The scope and arrangement of this third edition of the author's book on the life-history and control of household pests in the United States, chiefly species that are injurious to timbers, furniture, textiles or stored products or prejudice the health of man, resemble those of the earlier editions [*cf. R.A.E.*, A **42** 324, etc.], but the material has again been brought up to date, especially as regards control.

Coppel (H. C.). **Studies on Dipterous parasites of the spruce budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae). VI. *Phorocera incrassata* Smith (Diptera: Tachinidae).**—*Canad. J. Zool.* **36** no. 4 pp. 453–462, 13 figs., 8 refs. Ottawa, 1958.

This part of a series on Dipterous parasites of *Choristoneura fumiferana* (Clem.) in British Columbia [*cf. R.A.E.*, A **47** 343] contains accounts of

the bionomics and habits of *Phorocera incrassata* Smith, which in work already noticed [**38** 100] was rated fifth in importance among Dipterous and eighth among all parasites of this Tortricid. Its immature stages and the reproductive system of the female are described. Since *P. incrassata* appeared to be confined to western North America, parasitised host larvae were collected in western Canada and sent to Belleville, Ontario, where the parasite was reared in an attempt to introduce it into the east. In the laboratory, it developed in *Pieris rapae* (L.) as well as in *C. fumiferana*, but the latter is the only host recorded in the field. As a result of the work, over 500 adults were released in Ontario [*cf.* **36** 78], Newfoundland and New Brunswick. The following is based on the author's summary of the observations on the bionomics of the Tachinid. The females deposit microtype eggs on leaves, and these are later ingested by the host. They hatch immediately after ingestion, but the parasite larva does not develop beyond the first instar until the host pupates. It then develops rapidly, becomes full-fed in ten days and forms a puparium within the pupal case of the host. The adult emerges 12–14 days later. No information is available on the overwintering habits of the parasite, but there is possibly an alternative host [*cf.* **38** 487]. In British Columbia, the percentages of *C. fumiferana* parasitised during 1944–1949 did not exceed 0·5 and were usually considerably less. Preliminary investigations showed 0·3 per cent. parasitism among host larvae from Douglas fir [*Pseudotsuga menziesii*] and Engelmann spruce [*Picea engelmanni*] and 0·12 per cent. among those from alpine fir [*Abies lasiocarpa*]; altitude made little difference, and host larvae from juniper [*Juniperus*] were not attacked.

Henson (W. R.). **The effects of radiation on the habitat temperatures of some poplar-inhabiting insects.**—*Canad. J. Zool.* **36** no. 4 pp. 463–478, 8 figs., 9 graphs, 10 refs. Ottawa, 1958.

The temperatures characterising different insect habitats on the same plant part were investigated in Canada with insects living on the foliage of *Populus tremuloides*. The habitats concerned were leaf galls of different types formed by two unidentified species of *Cecidomyia*, the shoot galls of *Melanagromyza* (*Agromyza*) *schineri* (Giraud), leaves tied or rolled by *Choristoneura conflictana* (Wlk.) [*cf. R.A.E.*, A **45** 402] or rolled by *Compsolechia niveopulvella* (Chamb.), leaf mines of *Phyllocnistis populiella* (Chamb.) and leaf clusters formed by the distortion of shoots by the aphid, *Chaitophorus populifoliae* Davis. A preliminary study of undamaged leaves established that, at a radiation of 1·92 g.-cal. per sq. cm. per minute, the temperature of the upper surface was 21·3°C. [38·34°F.] and that of the lower surface 14·2°C. [25·56°F.] above the ambient temperature [*cf.* **40** 380]. The relation between habitat temperature, ambient temperature and radiation was found to be highly specific, and the degree of heating above the ambient temperature in the different habitats at a radiation of just under 2 g.-cal. per sq. cm. per minute ranged from 8°C. [14·4°F.] within leaves rolled by *Compsolechia niveopulvella* to nearly 26°C. [46·8°F.] in the hottest part of the leaf clusters of *Chaitophorus populifoliae*; within leaves tied and rolled by *Choristoneura conflictana*, the temperature was 22°C. [39·6°F.] and 14–15°C. [24·2–27°F.], respectively, above that of the ambient air. The possible ecological significance of these findings is discussed. The amount of heating experienced was influenced by the size and shape of the habitat structure, its absorptivity, and ventilation.

Thomson (H. M.). **The effect of a Microsporidian parasite on the development, reproduction, and mortality of the spruce budworm,** *Choristoneura fumiferana* **(Clem.).**—*Canad. J. Zool.* **36** no. 4 pp. 499–511, 1 graph, 7 refs. Ottawa, 1958.

The following is based on the author's summary of the results of investigations of the effect on *Choristoneura fumiferana* (Clem.) of parasitism by the species of Microsporidia described as *Perezia fumiferanae* [*cf. R.A.E.*, A **44** 290], carried out with material obtained mostly from a natural population from a forest in Ontario in which parasitism amounted to approximately 40 per cent. Infection retards both larval and pupal development and reduces pupal weight, fecundity and adult life. These effects were more pronounced among the females, and there was no evidence that the parasite affects male fertility, mate choice, or the fertility of eggs produced. The parasite causes some mortality, most of which occurred before the fifth instar. Among larvae infected orally, mortality seemed to be related to the size of the initial dose. It occurred equally in both sexes. The development and survival of the first-instar and overwintering second-instar larvae were not affected. It is suggested that the parasite causes most of the observed results by reducing the ability of the insect to assimilate food. Mortality, however, is believed to be due to the destruction of the mid-gut or Malpighian tubules.

Fox (C. J. S.) & Smeltzer (G. G.). **Control of the European wireworm** *Agriotes obscurus* **(L.) in Nova Scotia with insecticides applied to the soil.**—*Canad. J. Pl. Sci.* **39** no. 4 pp. 498–500, 3 refs. Ottawa, 1959.

Heavy infestation by *Agriotes obscurus* (L.) has caused severe damage to forage, cereal, root and potato crops for at least 20 years in a district in Nova Scotia [*cf. R.A.E.*, A **43** 117], and soil treatments were tested for its control in 1953–57 [*cf.* **47** 318]. The following is largely based on the authors' summary of the results. Aldrin and heptachlor applied at 4 lb. in 100 gal. emulsion spray per acre, and wettable γ BHC applied at 1·25 lb., in July 1953, significantly reduced the numbers of larvae per sq. ft. in experimental plots subsequently sown with a hay mixture containing timothy grass [*Phleum pratense*], red clover [*Trifolium pratense*] and alsike clover [*T. hybridum*] and caused an increase in the yield of dry leguminous fodder for three years after application. Treatment in May 1954 with the aldrin or heptachlor spray or with aldrin granules, all at 3 lb. toxicant per acre, applied to plots under a rotation of potatoes, oats and hay was followed by increased yields of oats during the second season after application, and of leguminous fodder plants during the third, but potatoes grown immediately after the treatment were not significantly less injured by wireworms than those in untreated check plots.

Clarke (J. F. G.). **The correct name for a pest of beans (Lepidoptera, Olethreutidae).**—*Proc. ent. Soc. Wash.* **60** no. 4 p. 187. Washington, D.C., 1958.

Cydia (*Laspeyresia*) *leguminis* (Heinr.) [*R.A.E.*, A **31** 364; **36** 134] was found by comparison of a specimen from Columbia with the type of *C.* (*L.*) *fabivora* (Meyr.) [**17** 245] to be a synonym of the latter. *C. fabivora* is an important pest of lima and string beans, and it occurs in Colombia, Peru, Panama, Salvador and Mexico.

Ossowski (L. L. J.). **Spraying experiments with insecticides against wattle bagworm,** *Kotochalia junodi* **(Heyl.). II.**—*Rep. Wattle Res. Inst. Univ. Natal 1957–58* pp. 37–39, 2 refs. Pietermaritzburg, 1958.

The following is substantially the author's summary of this second paper in a series [*cf. R.A.E.*, A **46** 70], in which he records the results of tests of sprays against *Kotochalia junodi* (Heyl.) on wattle [*Acacia*] in South Africa in late 1957. Single tree plots were treated from the ground with toxaphene, endrin and a similar chlorinated hydrocarbon referred to as WL 1650. The insecticides were dissolved in light diesel oil, toxaphene at 0·75 and the other two at 0·67 oz. per gal., and the sprays were applied at 2 gal. per acre. The trees were 4–6 ft. high. One experiment was carried out when the larvae were in their earlier instars, and another when they were older. Mortality was assessed after 11 and 14 days, respectively, and the rate of fall-off of dead and moribund larvae was also determined up to the time of mortality assessment. There was no difference in the final percentage fall-off between treated plots in either experiment [*cf.* **46** 300], though in the first experiment the initial rate was highest for endrin. There was no significant difference in over-all toxicity between the insecticides applied against the younger larvae, which gave 91·3–92·6 per cent. corrected mortality, but endrin was significantly superior to the others against the older larvae, giving 96·5 per cent. corrected mortality, as compared with about 82 per cent.

Ossowski (L. L. J.) & Wortmann (G. B.). **An annotated list of wattle insects and spiders of southern Africa.**—*Rep. Wattle Res. Inst. Univ. Natal 1958–59* pp. 32–49, 3 pls. Pietermaritzburg, 1959.

A list is given of 227 insects and 14 spiders found associated with wattle [*Acacia*] in plantations in South Africa or neighbouring territory in 1949–59 and of two insects found damaging imported seed. The insects include numerous pests and their natural enemies, and notes on the importance and habits of these are included. Of the pests, *Kotochalia junodi* (Heyl.) is the commonest and most injurious [*cf. R.A.E.*, A **47** 452], although it is attacked by parasites, predators and diseases.

Davies (J. C.). **Aluminium phosphide for bulk grain fumigation in Uganda.**—*E. Afr. agric. J.* **24** no. 2 pp. 103–105, 1 ref. Nairobi, 1958.

The author describes an experiment in Uganda in 1958, in which maize was fumigated with phosphine released from tablets of aluminium phosphide and ammonium carbamate [*cf. R.A.E.*, A **48** 127, etc.]. It was made in a plant consisting of a series of steel bins, each with a capacity of 4,000 bags, and the tablets were added to the grain stream of 387 bags on 14th February, as this quantity of maize was transferred from one of the bins to another; the rate was about 1 tablet per bag (10·2 per ton). The operation took just over 1½ hours, and the workers, who wore rubber gloves, suffered no inconvenience from the phosphine; there is very little evolution of the gas for the first hour, and it is usually unnecessary to wear a respirator while applying the tablets. Samples taken before fumigation showed that the moisture content averaged 12·5 per cent. and that the maize was heavily infested by insects, including *Sitophilus* (*Calandra*) *oryzae* (L.), *Tribolium castaneum* (Hbst.), *Tenebroides mauritanicus* (L.) and species of *Cryptolestes*, mainly *C. pusillus* (Schönh.) (*minutus* (Ol.)). The maize was not disturbed until 19th March,

when it was transferred to another bin. There was a slight smell of phosphine during this process, but no ill effects resulted from it, and only two of 19 samples of grain taken at intervals of 5–10 minutes contained a living insect; one was an adult of *Tribolium*, which might have flown in during sampling, and the other was one of *Sitophilus*, which was in the final sample. After incubation for a month, this sample proved to be infested by a potentially dangerous population of *Tribolium*. It had been obtained by banging the sides of the bin, and the dirt and dust in it may have prevented satisfactory penetration of the fumigant. Most of the other samples contained no living insects on incubation.

Curry (S. J.). **The control of ambrosia beetle attack on logs.**—*E. Afr. agric. J.* **24** no. 2 pp. 128–132, 3 figs., 2 refs. Nairobi, 1958.

In the main forest areas of Kenya, ambrosia beetles (Platypodids and Scolytids) are widespread from sea-level to an altitude of over 9,000 ft., but damage to felled logs is important only in areas with a warm humid climate below 7,000 ft. Both logs and over-mature standing trees of *Olea welwitschii* were found to be particularly susceptible to attack, almost entirely by *Chaetastus* (*Symmerus*) *montanus* Schedl, in three localities examined, and a test with such logs, which were sprayed to cover the whole of the bark surface and cut ends as soon as possible after cutting and scattered at random in the shade near infested logs or trees, showed that treatment with 1 per cent. γ BHC in oil gave protection that was complete for seven weeks and almost complete for a further ten weeks of dry weather and 21 weeks of wet weather, whereas untreated logs were attacked within 24 hours.

In similar tests, spraying logs of *Ekebergia rueppelliana* with 1 per cent. γ BHC in oil solution or water emulsion did not protect them from attack by *Doliopygus nairobiensis* (Schedl), *D. serratus* (Strohm.) and *Triozastus propatulus* (Schedl), possibly because of incomplete coverage of some, but 2 per cent. γ BHC in oil solution or water emulsion gave considerable protection of *Celtis soyauxii* for 13 weeks and 2 per cent. γ BHC in suspension or oil solution protected *Croton megalocarpus* for 8–32 weeks from many beetles, including species of *Doliopygus*, *Platypus*, *Trachyostus*, *Chaetastus* and *Periommatus*. On *Polyscias kikuyuensis*, attacked by 11 species of *Doliopygus*, *Platypus*, *Chaetastus* and *Trachyostus*, emulsions containing 1–2 per cent. dieldrin were generally less effective than BHC formulations; 1 per cent. γ BHC in solution or suspension gave better control than 0·5 per cent. BHC in solution over 44 weeks in one test, and 1 per cent. γ BHC was more effective after 24 weeks in oil solution with tar additives than in water suspension, oil solution or a paint in another.

It is recommended that γ BHC suspension in water should be used, at 1 per cent. in dry weather and 2 per cent. in wet weather, to protect logs from the beetles for the period of 2–3 months usually necessary. An oil solution of 1 per cent. γ BHC, preferably with tar additives, should be used if protection is needed for 4–6 months in wet weather.

Brenière (J.). **Essais d'insecticides à l'égard de *Gonocephalum simplex* Fabr., ténébrionide nuisible au tabac en cours de repiquage à Madagascar.**—*Agron. trop.* **14** no. 4 pp. 459–469. Paris, 1959. (With summaries in English & Spanish.)

Adults of *Gonocephalum simplex* (F.) damage transplanted tobacco seedlings in Madagascar by feeding on the collar and the leaves resting on

the soil, before the plants regain turgescence, and they may destroy a whole crop. Later attack is unusual, so that, provided the plants are protected for about a fortnight, total destruction of the beetles is unnecessary. In 1957, dusts of 1·25 per cent. lindane [almost pure γ BHC] or dieldrin and an emulsion concentrate containing 17·5 per cent. endrin were compared with a 5 per cent. aldrin dust, which was known to be effective. The dusts were mixed with the soil from the hole dug for each plant at transplanting and the emulsion concentrate was diluted and applied round the stem immediately after transplanting, to give doses of about 0·05 g. actual insecticide per plant. Examination 3–19 days later showed that γ BHC retarded plant growth so severely that its use was not advisable, whereas the other materials had little adverse effect on the plants and were very effective against the insects, with no significant difference between them; dieldrin and endrin were also applied at double the dosage, but this did not improve control. Aldrin was further tested in an aqueous suspension, in which the plants were dipped, and as the undiluted dust, to coat the roots, and was as effective against the insects when applied by these methods as when mixed with the soil, but retarded plant growth.

Coconut Pests and Diseases Board. Report for period 1st June, 1957 to 31st May, 1958.—*Coun. Pap. Fiji* 1958 no. 41, 8 pp., 1 map, 1 graph. Suva, 1958. **1st June, 1958 to 31st May, 1959.**—*Op. cit.* 1959 no. 30, 6 [+1] pp., 1 map, 1 graph. 1959.

These reports each contain a section on the distribution and incidence of *Oryctes rhinoceros* (L.) on coconut in Viti Levu, Fiji, a map showing its spread each year since 1955 and an appendix by H. W. Simmonds on biological control [*cf. R.A.E.*, A **46** 105]. By May 1958, the area infested by *O. rhinoceros* had extended about 12 miles further along the south coast and about four along the north, and a year later it had extended further by about six miles along both coasts. The main breeding areas in the south-east remained unaltered, and no damage or breeding occurred in an extended area inland. Adults were collected at light and in the crowns of the palms in the breeding areas in both years, and in 1958–59 nearly 87 per cent. of the total were taken in the three main south-eastern breeding areas; of those taken in the crowns (96·3 per cent. of the total) in 1957–58, 5 per cent., of which 53·3 per cent. were females, were dead and were thought to have been killed by insecticides; the corresponding percentage for 1958–59 was 1·7. Owing to the increased cost of control with the extension of the infestation, work in the outlying areas was curtailed in 1957–58 and still further reduced in 1958–59, when treatment of palms with BHC was discontinued in inland areas and along the south coast, except, occasionally, round Navua, reduced on the north-east coast, and concentrated in the south-east, where populations were highest. Natural enemies introduced during 1957–58 included a nematode from Madagascar, closely related to the one previously introduced from Ceylon [*cf. loc. cit.*]. An improved breeding method, involving the use of killed host larvae, was employed for both and breeding and distribution was continued during both years.

The appendix to the first report covers the period from 1st June 1957 to 30th August 1958 and that to the second from the latter date to 30th June 1959. A consignment of the predacious Carabid, *Scarites madagascariensis* Dej. was received in September 1957, and 131 adults were released, but large numbers of toads were later found at the liberation site and it is therefore unlikely that any Carabid would survive. A considerable

reduction in numbers of *Oryctes* that occurred in one district was attributed to the action of the Histerid predator, *Hololepta* (*Leionota*) sp. [*cf. loc. cit.*], introduced from Trinidad, but none was recovered in normal breeding sites. Work on the introduction of the parasite, *Scolia ruficornis* F., is reviewed in both appendices. Some 230 cocoons received from the Palau Islands at the end of May 1958 were used as breeding stock and placed under sawdust heaps to which larvae of *Oryctes* were added. In a footnote to the first appendix, the parasite is stated to pupate at depths ranging down to 10 in. or more in the soil below the heap. In August 1958, 25–30 fresh cocoons, two fully grown larvae and two eggs of *S. ruficornis* were found in a heap round which adult males were flying, and these were transferred to another heap about a mile away. Many dead *Oryctes* larvae appeared to have been punctured by female parasites; they either received no eggs or, more probably, died before the parasite larvae had matured. One *Oryctes* larva was infested by a fungus and showed hyphae coming from the spiracles. Difficulties operating against successful establishment are enumerated in the second appendix. The greatest is the heavy mortality that occurs among the larvae during diapause in the cocoon, which may continue for several months, and others include the scattered host population and parasitism by a nematode, presumably a local species, that evidently passed from the host to the parasite larva. The parasite population at the breeding base decreased considerably after a hurricane in December 1958, which destroyed many of the flowers at which the adults feed, but improved towards the end of May; at the end of June, 416 fresh cocoons were found in the heaps. During the year, another breeding station was established about ¼ mile away, and colonies were liberated at two other places, one on the south coast.

Cohic (F.). **Les parasites animaux de la tomate.**—[11] pp., 8 figs. Noumea, Inst. franç. Océanie [1958].

Tomato in New Caledonia is attacked by *Euxoa radians* (Gn.), *Empoasca flavescens* (F.), *Macrosiphum solanifolii* (Ashm.), *Plusia chalcites* (Esp.), *Mictis profana* F., *Gnorimoschema operculella* (Zell.), *Monolepta semiviolacea* Fauvel, *Cyrtopeltis* (*Engytatus*) *nicotianae* (Kön.), *Heliothis armigera* (Hb.), *Nezara viridula* (L.), *Lygaeus leucopterus* (Goeze) (*venustus* Boeb.) and *Aculus* (*Phyllocoptes*) *lycopersici* (Massee) and damaged by the burrowing activities of *Gryllotalpa australis* Erichs. and by nematodes. Notes on the bionomics and control of these are given, together with a key arranged according to the type of injury caused.

Papers noticed by Title only.

Bhasin (G. D.), Roonwal (M. L.) & Balwant Singh. **A list of insect pests of forest plants in India and the adjacent countries (arranged alphabetically according to the plant genera and species, for the use of forest officers). Part 3. List of insect pests of plant genera 'A' (appendix only), 'B' (*Baccaurea* to *Buxus*) and 'C' (in part) (*Cadaba* to *Citrus*).**—*Indian For. Bull.* (N.S.) Ent. no. 171 (2), [1] 126 pp. Delhi, 1958. [*Cf. R.A.E.*, A **44** 64.]

Strong (R. G.) & Okumura (G. T.). **Insects and mites associated with stored foods and seeds in California.**—*Bull. Calif. Dep. Agric.* **47** no. 3 pp. 233–249, 9 figs., 4 refs. Sacramento, Cal., 1958.

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